

**DRAFT
TECHNICAL SPECIFICATIONS
FOR
GOLDEN VALLEY RANCH
WELL #1**

February 2006

Prepared by:



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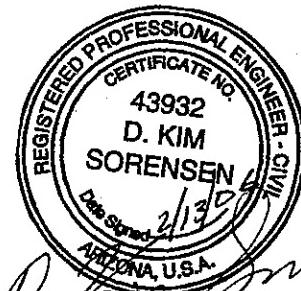


TABLE OF CONTENTS

TITLE		PAGE
TECHNICAL SPECIFICATIONS		
DIVISION 1	GENERAL REQUIREMENTS	
Section 01110	Summary of Work (DKS)	1 thru 2
Section 01310	Project Meetings (DKS)	1 thru 2
Section 01330	Submittals (DKS)	1 thru 5
Section 01400	Quality Requirements (DKS)	1 thru 10
Section 01500	Temporary Facilities and Temporary Controls (DKS)	1 thru 4
Section 01530	Protection of Existing Facilities (DKS)	1 thru 3
Section 01600	Product Requirements (DKS)	1 thru 3
Section 01740	Cleaning (DKS)	1 thru 2
Section 01770	Closeout Procedures (DKS)	1 thru 3
Section 01780	Closeout Submittals (DHB)	1 thru 2
Section 01785	Operating and Maintenance Data (DKS)	1 thru 6
DIVISION 2	SITE CONSTRUCTION	
Section 02200	Earthwork (DKS)	1 thru 11
Section 02576	Ductile Iron Pipe (DKS)	1 thru 4
Section 02577	PVC Pressure Pipe (DKS)	1 thru 4
Section 02578	PVC Sewer Pipe (DHB)	1 thru 2
Section 02643	Water Pipeline Testing and Disinfection	1 thru 5
Section 02830	Chain Link Fence and Gate	1 thru 10
DIVISION 3	NOT USED	
DIVISION 4	NOT USED	
DIVISION 5	NOT USED	
DIVISION 6	NOT USED	
DIVISION 7	NOT USED	
DIVISION 8	NOT USED	
DIVISION 9	FINISHES	
Section 09800	Protective Coatings (DKS)	1 thru 11
DIVISION 10	NOT USED	
DIVISION 11	EQUIPMENT	
Section 11000	Equipment General Provisions (DKS)	1 thru 12
Section 11261	Chlorination Equipment (DKS)	1 thru 7
DIVISION 12	NOT USED	
DIVISION 13	NOT USED	
DIVISION 14	NOT USED	

TABLE OF CONTENTS

DIVISION 15	NOT USED	
Section 15000	Piping General (DKS)	1 thru 9
Section 15006	Pipe Supports (DKS)	1 thru 6
Section 15010	Mill Piping (DKS)	1 thru 4
Section 15180	Strainers (DKS)	1 thru 2
Section 15183	Gauges (DKS)	1 thru 2
Section 15200	Valves, General (DKS)	1 thru 6
Section 15201	Valve Actuators (DKS)	1 thru 7
Section 15202	Butterfly Valves (DKS)	1 thru 2
Section 15203	Check Valves (DKS)	1 thru 4
Section 15206	Gate Valves (DKS)	1 thru 4
Section 15230	Misc Valves (DKS)	1 thru 3
DIVISION 16	ELECTRICAL	
Section 16001	Basic Electrical Materials and Methods (DKG)	1 thru 6

1175 GOLDEN VALLEY RANCH WELL NO.1

**ELECTRICAL AND INSTRUMENTATION
SPECIFICATIONS**

DIVISION 16

- 16000 GENERAL ELECTRICAL REQUIREMENTS
- 16111 CONDUITS
- 16123 600 VOLT CLASS CABLE
- 16124 INSTRUMENTATION CLASS CABLE
- 16130 OUTLET, PULL, AND JUNCTION BOXES
- 16141 WIRING DEVICES
- 16143 TERMINAL BLOCKS
- 16160 ENCLOSURES
- 16161 CONTROL PANELS
- 16170 GROUNDING
- 16190 SUPPORTING DEVICES
- 16195 ELECTRICAL IDENTIFICATION
- 16305 5KV CLASS CABLE
- 16325 LIQUID FILLED – COMPARTMENTAL TYPE – PAD MOUNTED TRANSFORMERS
- 16341 MEDIUM VOLTAGE LOAD INTERRUPTER SWITCHGEAR
- 16343 MEDIUM VOLTAGE METAL CLAD SWITCHGEAR
- 16347 MEDIUM VOLTAGE SOLID STATE REDUCED VOLTAGE MOTOR CONTROLLER
- 16420 SERVICE ENTRANCE SECTION
- 16430 CUSTOMER POWER METERING SYSTEM
- 16440 DISCONNECT SWITCHES
- 16470 PANELBOARDS
- 16474 MOTOR CONTROL EQUIPMENT
- 16475 MINI POWER CENTERS
- 16476 LOW VOLTAGE CIRCUIT BREAKERS
- 16477 600V FUSES
- 16500 LIGHTING
- 16505 TRANSIENT VOLTAGE SURGE SUPPRESSION SYSTEM
- 16902 ELECTRICAL CONTROL DEVICES
- 16907 PROGRAMMING AND CONTROL DESCRIPTION
- 16920 ELECTRICAL ACCEPTANCE TESTING



DIVISION 17

17000 INSTRUMENTATION
17121 PRESSURE SWITCHES
17124 SUBMERSIBLE LEVEL TRANSMITTER
17137 MAGNETIC FLOWMETERS
17150 LIMIT AND POSITION SWITCHES
17222 SIGNAL CONDITIONERS

LIST OF DRAWINGS

SHEET NO.	DRAWING NO.	DESCRIPTION
1	G1	COVER SHEET
2	C2	SITE PLAN & DISCHARGE PLANS
3	WP1	PUMP & DISCHARGE DETAILS
4	WP2	DETAILS
5	WP3	DETAILS
6	PP1	PUMP TO WASTE PLAN AND PROFILE
7	E1	SITE ELECTRICAL PLAN
8	GI1	INSTURMENTATION AND CONTROLS LEGEND
9	I1	WELL PUMP P&ID
10	E1	SITE ELECTRICAL PLAN

**SECTION 01110
SUMMARY OF WORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Work.
- B. CONTRACTOR'S use of Site.
- C. Work sequence.
- D. OWNER occupancy.
- E. Storm water pollution prevention plan (SWPPP).

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work comprises construction of a 1700 gallon per minute well including the following:

- 1. Setting of well pump and motor (Well pump and motor supplied by others).
- 2. Foundation work.
- 3. Chlorination Facility
- 4. Well discharge piping and valves.
- 5. Chlorination and testing.

B. Work comprising the Site construction includes the following:

- 1. Site excavation, backfill and compaction.
- 2. Site piping, valves, etc.
- 3. Site electrical.
- 4. Chain link fence.
- 5. Site access road.

C. Project Site is located in Mohave County, Arizona.

D. The Work includes:

- 1. Furnishing of all labor, material, superintendence, power, light, heat, fuel, water, tools, appliances, equipment, supplies, services and other means of construction necessary or proper for performing and completing the work.
- 2. Sole responsibility for the adequacy of labor and equipment.
- 3. Maintaining the work area and site in a clean and acceptable manner.
- 4. Protection of finished and unfinished work.
- 5. Repair and restoration of work damaged during construction.

**SECTION 01110
SUMMARY OF WORK**

6. Furnishing, as necessary, proper equipment and machinery, of a sufficient capacity, to facilitate the work and to handle all emergencies normally encountered in work of this character.
7. Furnishing, installing, and protecting all necessary guides, tracks, rails, bearing plates, anchor and attachment bolts, and all other appurtenances needed for the installation of the devices included in the equipment specified. Make anchor bolts of appropriate size, strength and material for the purpose intended. Furnish substantial templates and shop drawings for installation.

1.03 CONTRACTOR'S USE OF SITE

- A. Limit use of Site and premises for Work, storage, and to allow for:
1. Coordinating Work under this Contract with work of other contractors where Work under this Contract encroaches on work of other contractors.
 2. Coordination of site use with ENGINEER and OWNER, and daily use patterns for parking, and roadway travel.
 3. Responsibility for protection and safekeeping of products under this Contract.
 4. Providing additional off-site storage at no additional cost to OWNER as needed.
 5. Coordinating this section with all others sections as required in the General Conditions.

1.04 WORK SEQUENCE

- A. The well pump and motor are currently at the site and being used by the OWNER to supply construction water. The CONTRACTOR will be required to extend the pump column and shaft to the finish grade as shown on the plans and reset the pump motor on the new pump foundation as shown on the plans.

1.05 OWNER OCCUPANCY

- A. CONTRACTOR shall at all times conduct its operations as to ensure least inconvenience to general public.

1.06 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

- A. The CONTRACTOR shall submit and implement the stipulations of a storm water pollution prevention plan (SWPPP).

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01310
PROJECT MEETINGS**

PART 1 GENERAL

1.01 PRECONSTRUCTION CONFERENCE

- A. Prior to commencement of Work at Site, preconstruction conference will be held at mutually agreed time and place. Conference shall be attended by:
 1. CONTRACTOR and its superintendent.
 2. Principal Subcontractors.
 3. ENGINEER.
 4. Representatives of OWNER.
 5. Governmental representatives as appropriate.
 6. Others as requested by CONTRACTOR, OWNER, or ENGINEER.
- B. Purpose of conference is to designate responsible personnel and establish working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. Agenda will include:
 1. CONTRACTOR'S tentative schedules.
 2. Transmittal, review, and distribution of CONTRACTOR'S submittals.
 3. Processing applications for payment.
 4. Maintaining record documents.
 5. Critical Work sequencing.
 6. Field decisions and Change Orders.
 7. Use of premises, office and storage areas, security, housekeeping, and OWNER'S needs.
 8. Major equipment deliveries and priorities.
 9. CONTRACTOR'S assignments for safety and first aid.
- C. OWNER will preside at preconstruction conference and will arrange for keeping minutes and distributing minutes to persons in attendance.

1.02 CONSTRUCTION PROGRESS MEETINGS

- A. CONTRACTOR shall schedule and hold regular progress meetings at least bi-weekly and at other times as requested by the ENGINEER or as required by the progress of the Work.
- B. CONTRACTOR, ENGINEER, and all Subcontractors active on the site shall be represented at each meeting.
- C. OWNER and CITY shall be given at least 48 hours notice of meeting and may attend at their discretion.
- D. Meetings shall be held at the job-site in the ENGINEER'S office.

**SECTION 01310
PROJECT MEETINGS**

- E. CONTRACTOR shall preside at meetings.
- F. CONTRACTOR shall prepare and distribute two week look ahead schedule.
- G. ENGINEER will prepare and distribute meeting minutes.
- H. The purpose of the meeting will be the following:
 - 1. Review the progress of the Work.
 - 2. Discuss upcoming Work activities.
 - 3. Discuss changes in scheduling.
 - 4. Resolve other problems that may arise.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01330
SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Welding certificates.
- D. Field performance tests.
- E. Shop Drawings.
- F. Product Data.
- G. Samples.
- H. Engineer's duties.

1.02 SUBMITTAL PROCEDURES

A. Deliver submittals to:

Mr. Dennis Atwood, P.E.
Stanley Consultants, Inc.
5820 S. Eastern Avenue, Suite 200
Las Vegas, NV 89119

- B. Transmit each item under Shop Drawing Transmittal Form, bound herein. Identify Project, CONTRACTOR, Subcontractor, and major supplier; identify pertinent Drawing sheet and detail number, and Specification section number, as appropriate. Identify deviations from Specifications. Provide space for CONTRACTOR and ENGINEER review stamps on each item. Shop Drawings will be submitted within the first 90 days after agreement is signed.
- C. Submit initial progress schedules and schedule of values in duplicate within 15 days after award of contract. After review by ENGINEER revise and resubmit as required.
- D. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- E. Notify ENGINEER in writing, at time of submission, of any deviations in submittals from requirements of Contract Documents. Any such deviations permitted by ENGINEER will require modifications of Contract Documents.
- F. Begin no fabrication or Work which requires submittals until return of submittals by ENGINEER with ENGINEER stamp, as either "No Exceptions Taken" or "Make Corrections Noted."

**SECTION 01330
SUBMITTALS**

- G. After ENGINEER review of submittal, revise and resubmit as required, identifying changes made since previous submittal.
- H. Distribute reproductions of Shop Drawings which carry ENGINEER stamp as either "No Exceptions Taken" or "Make Corrections Noted" to:
 1. Job site file.
 2. Record documents file.
 3. Other affected contractors.
 4. Subcontractors.
 5. Supplier or fabricator.
 6. Two copies to OWNER (Quality Control).
- I. Distribute Samples which carry ENGINEER stamp as either "No Exceptions Taken" or "Make Corrections Noted" as directed by ENGINEER.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit horizontal bar chart with separate bar for each major trade or operation, identifying first work day of each week.
- B. Show complete sequence of construction by activity, identifying work of separate stages and other logically grouped activities. Show projected percentage of completion for each item of Work as of time of each progress Application for Payment.
- C. Show submittal dates required for Shop Drawings, Product Data, and Samples, and Product delivery dates, including those furnished by OWNER and those under Allowances.

1.04 WELDING CERTIFICATES

- A. Promptly after Notice of Award, submit to ENGINEER one copy, unless specified otherwise, for each person, by name, assigned to do field welding of materials installed under this Agreement.
- B. Show on certificates that each person has passed tests specified by AWS.
- C. Submit certificates prior to execution of any welding. Certificates not required for nonstructural tack welding.

1.05 FIELD PERFORMANCE TESTS

- A. After system or equipment necessary for operation of Work is in operating condition, CONTRACTOR shall supervise operation of equipment or system for period sufficient to assure proper functioning, and make necessary observations, investigations, and adjustment.
- B. Notify OWNER when Work is considered to be complete, in operating condition, and ready for inspection and tests.

**SECTION 01330
SUBMITTALS**

- C. OWNER and CONTRACTOR will conduct tests it deems necessary to determine if equipment or system functions properly.
- D. If equipment or system fails to function properly, CONTRACTOR shall make necessary corrections, including replacement, at no cost to OWNER, and after such corrections are completed, demonstrate to ENGINEER that equipment or system functions properly.

1.06 SHOP DRAWINGS

- A. Shop Drawings shall be presented in clear and thorough manner, complete with respect to dimensions, design criteria, materials of construction, and like information to enable ENGINEER to review information as required. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Drawings.
- B. Minimum sheet size: 8-1/2" x 11". All sheets larger shall be folded to 8-1/2" x 11".
- C. Shop Drawings:
 1. Submit one opaque reproducible copy of each Shop Drawing.
 2. Shop Drawings not larger than 24" x 36", copies of Drawings submitted shall be black line on white background or reproducible mylars.
 3. CONTRACTOR shall submit 8 copies of each Shop Drawing.
- D. Reproducible copies of Shop Drawings, if requested herein:
 1. Submit one "mylar," or equal, reproducible print. Vellum sepia or other nonpermanent reproducible prints are not acceptable.
 2. Reproducible copies of Shop Drawings shall show "as built" conditions of equipment and shall show field modifications required during installation.
 3. CONTRACTOR will provide marked up print of application Shop Drawings showing field modifications made during installation, within 5 days after it has sufficient information to prepare same.
- E. Submittals shall contain:
 1. Date of submission and dates of any previous submissions.
 2. Project title and number.
 3. Contract identification.
 4. Names of:
 - a. CONTRACTOR.
 - b. Supplier.
 - c. Manufacturer.
 5. Identification of product, with Specification section number.
 6. Field dimensions, clearly identified as such.
 7. Relation to adjacent or critical features of Work or materials.

SECTION 01330 SUBMITTALS

8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8" x 3' blank space for CONTRACTOR and ENGINEER stamps.
12. Indication of CONTRACTOR'S approval, initialed or signed, with wording substantially as follows:

"CONTRACTOR represents to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or assumes full responsibility for doing so and has reviewed or coordinated each Shop Drawing Sample with requirements of Work and Contract Documents."

- F. Resubmission requirements: Make any corrections or changes in submittals required by ENGINEER and resubmit until stamped as either "No Exceptions Taken" or "Make Corrections Noted" by ENGINEER. Indicate any changes which have been made other than those requested by ENGINEER.

1.07 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to Work. Include manufacturers' installation instructions when required by Specification section.
- B. Submit the number of copies which CONTRACTOR requires, plus 2 copies which will be retained by ENGINEER.

1.08 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures, and patterns for ENGINEER'S selection. Submit samples for selection of finishes within 30 days after date of Contract.
- B. Submit Samples to illustrate functional characteristics of product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- C. Include identification on each Sample, giving full information.
- D. Submit number specified in respective Specification section; one will be retained by ENGINEER. Samples which may be used in Work are indicated in Specification section.
- E. Provide field finishes at Project as required by individual Specifications section. Install Sample complete and finished. Acceptable finishes in place may be retained in completed Work.

SECTION 01330 SUBMITTALS

1.09 ENGINEER DUTIES

- A. Review required submittals with reasonable promptness and in accord with schedule, only for general conformance to design concept of Project and compliance with information given in Contract Documents. Review shall not extend to means, methods, sequences, techniques, or procedures of construction or to safety precautions or program incident thereto. Review of a separate item as such will not indicate approval of assembly in which item functions.
- B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or review of submittal. ENGINEER'S action on submittals is classified as follows:
 1. **No Exception Taken:** Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents. CONTRACTOR may proceed with fabrication of work in submittal.
 2. **Make Corrections Noted:** Submittal has been reviewed and appears to be in conformance to design concept of Project and Contract Documents, except as noted by ENGINEER. CONTRACTOR may proceed with fabrication of work in submittal with modifications and corrections as indicated by ENGINEER.
 3. **Amend-Resubmit:** Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract Documents. CONTRACTOR shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by ENGINEER and resubmit for review.
 4. **Rejected-Resubmit:** Submittal has been reviewed and appears not to be in conformance to design concept of Project or with Contract documents. CONTRACTOR shall not proceed with fabrication of work in submittal, but instead shall make any corrections required by ENGINEER and resubmit for review.
- C. Return submittals to CONTRACTOR.
- D. ENGINEER'S review of submittals shall not relieve CONTRACTOR from responsibility for any deviations from Contract Documents unless CONTRACTOR has, in writing, called ENGINEER'S attention to such deviation at time of submission, and ENGINEER has given written concurrence pursuant to Contract Documents to specific deviation, nor shall any concurrence by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in submittals. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

- END OF SECTION -

**SECTION 01400
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Quality control.
- B. Workmanship.
- C. Manufacturer's instructions.
- D. Manufacturer's certificates.
- E. Testing laboratory services.

1.02 RELATED REQUIREMENTS

- A. Conditions of Agreement: Inspection and testing required by OWNER and governing authorities.
- B. Section 01330 - Submittals: Submittal of manufacturers' instructions.
- C. Section 03300 – Cast-in-Place Concrete: Tests required for concrete.

1.03 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.

1.04 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform Work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.05 MANUFACTURERS' INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding.

1.06 MANUFACTURERS' CERTIFICATES

- A. When required by individual Specifications section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

**SECTION 01400
QUALITY REQUIREMENTS**

1.07 TESTING LABORATORY SERVICES

- A. CONTRACTOR shall employ and pay for services of independent testing laboratory to perform inspections, tests, and other services required by various Specification sections.
 - 1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full time registered ENGINEER and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
- B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by the Authority having jurisdiction.
 - 1. Laboratory: Authorized to operate in location in which Project is located.
 - 2. Laboratory Staff: Maintain a full time registered ENGINEER on staff to review services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off the project site. Perform off site testing as required by the OWNER or ENGINEER.
- D. Reports will be submitted by the independent firm to the ENGINEER and CONTRACTOR, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
 - 1. Notify ENGINEER and independent firm 24 hours prior to expected time for operations requiring services.
 - 2. Make arrangements with independent firm and pay for additional samples and tests required for CONTRACTOR'S use.
- F. Testing and employment of testing agency or laboratory shall not relieve CONTRACTOR of obligation to perform Work in accordance with requirements of Contract Documents.
- G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the ENGINEER at no additional cost to the OWNER.
- H. Agency Responsibilities:
 - 1. Test samples of mixes submitted by CONTRACTOR.
 - 2. Provide qualified personnel at site. Cooperate with ENGINEER and CONTRACTOR in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

**SECTION 01400
QUALITY REQUIREMENTS**

5. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or non-conformance of Work or products.
 6. Perform additional tests required by ENGINEER.
 7. Attend preconstruction meetings and construction progress meetings.
- I. Agency Reports: After each test, promptly submit two copies of report to ENGINEER and CONTRACTOR. When requested by ENGINEER, provide interpretation of test results. Include the following:
1. Date issued.
 2. Project title and number.
 3. Name of inspector.
 4. Date and time of sampling or inspection.
 5. Identification of product and specifications section.
 6. Location in the Project.
 7. Type of inspection or test.
 8. Date of test.
 9. Results of tests.
 10. Conformance with Contract Documents.
- J. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency or laboratory may not approve or accept any portion of the Work.
 3. Agency or laboratory may not assume any duties of CONTRACTOR.
 4. Agency or laboratory has no authority to stop the Work.

1.08 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to ENGINEER 30 days in advance of required observations. Observer subject to approval of ENGINEER and OWNER.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**SECTION 01400
QUALITY REQUIREMENTS**

1.09 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current as of Bid Date, except where a specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. Should specified reference standards conflict with Contract Documents, request clarification from the ENGINEER before proceeding.
- E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the ENGINEER shall be altered from the Contract Documents by mention or inference otherwise in any reference document.
- F. Abbreviations used in Drawings and Specifications are as specified in ANSI Y1.1 and IEEE 260.
- G. Schedule of references:
 1. AA - Aluminum Association
 2. AAMA - Architectural Aluminum Manufacturer's Association
 3. AABC - Associated Air Balance Council
 4. AAMA - American Architectural Manufacturers Association
 5. AAN - American Association of Nurserymen
 6. AAR - Association of American Railroads
 7. AASHTO - American Association of State Highway and Transportation Officials
 8. ABMA - American Bearing Manufacturers Association
 9. ACI - American Concrete Institute
 10. ACGIH - American Conference of Governmental Industrial Hygienists
 11. ACIL - American Council of Independent Laboratories
 12. ADC - Air Diffusion Council
 13. ADSC - The International Association of Foundation Drilling
 14. AF&PA - American Forest & Paper Association
 15. AFS - American Foundrymen's Society
 16. AGA - American Gas Association
 17. AGMA - American Gear Manufacturers Association
 18. AHA - American Hardboard Association
 19. AI - Asphalt Institute

**SECTION 01400
QUALITY REQUIREMENTS**

20. AIChE - American Institute of Chemical Engineers
21. AISC - American Institute of Steel Construction
22. AISI - American Iron and Steel Institute
23. AITC - American Institute of Timber Construction
24. AMCA - Air Movement and Control Association
25. ANSI - American National Standards Institute
26. APA - American Pulpwood Association
27. EWA - The Engineered Wood Association
28. API - American Petroleum Institute
29. APMO - International Association of Plumbing
30. AREMA - American Railway Engineering and Maintenance of Way Association
31. ARI - Air-Conditioning and Refrigeration Institute
32. ARRA - Asphalt Recycling and Reclaiming Association
33. ASA - Acoustical Society of America
34. ASCE - American Society of Civil Engineers
35. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
36. ASME - American Society of Mechanical Engineers
37. ASPA - American Sod Producers Association
38. ASSE - American Society of Sanitary Engineering
39. ASTM - International Standards Worldwide
40. AWI - Architectural Woodwork Institute
41. AWPA - American Wood-Preservers' Association
42. AWS - American Welding Society
43. AWWA - American Water Works Association
44. BIA - Brick Industry Association
45. BOCA - Building Officials & Code Administrators International, Inc.
46. CDA - Copper Development Association Inc.
47. CBM - Certified Ballast Manufacturers Association
48. CEMA - Conveyor Equipment Manufacturer's Association
49. CGA - Compressed Gas Association
50. CISCA - Ceilings and Interior Systems Construction Association
51. CISPI - Cast Iron Soil Pipe Institute
52. CLFMI - Chain Link Fence Manufacturers Institute
53. CMAA - Crane Manufacturers Association of America

**SECTION 01400
QUALITY REQUIREMENTS**

54. CPSC - Consumer Products Safety Council
55. CRI - Carpet and Rug Institute
56. CRSI - Concrete Reinforcing Steel Institute
57. CSSB - Cedar Shake and Shingle Bureau
58. CTI - Cooling Technology Institute
59. DASMA - Door and Access Systems Manufacturers Association International
60. DHI - Door and Hardware Institute
61. DIN - Deutsche Normen
62. EIA - Electronic Industries Alliance
63. EIMA - EIFS Industry Members Association
64. EJMA - Expansion Joint Manufacturers Association
65. EPA - Environmental Protection Agency
66. ETL - Electrical Testing Laboratory
67. FAA - Federal Aviation Administration
68. FM - FM Global
69. FS - Federal Specification Unit
70. GA - Gypsum Association
71. GANA - Glass Association of North America
72. HI - Hydraulics Institute
73. HI - Hydronics Institute
74. HMI - Hoist Manufacturer's Institute
75. HMMA - Hollow Metal Manufacturers Association
76. HPVA - Hardwood Plywood and Veneer Association
77. IAS - International Approval Services
78. IAPMO - International Association of Plumbing and Mechanical Officials
79. ICAC - Institute of Clean Air Companies
80. ICBO - International Conference of Building Officials
81. ICC - International Code Council, Inc.
82. ICEA - Insulated Cable Engineers Association
83. IEC - International Electro technical Council
84. IEEE - Institute of Electrical and Electronics Engineers
85. IES - Illuminating Engineering Society
86. IETF - Internet Engineering Task Force
87. IGCC - Insulating Glass Certification Council

**SECTION 01400
QUALITY REQUIREMENTS**

88. ILI - Indiana Limestone Institute of America
89. ISA - The Instrumentation, Systems, and Automation Society
90. ISO - International Standards Organization
91. ITU - International Telecommunications Union
92. KCMA - Kitchen Cabinet Manufacturers Association
93. LPI - Lightning Protection Institute
94. MBMA - Metal Building Manufacturers Association
95. MFMA - Maple Flooring Manufacturers Association
96. MIA - Marble Institute of America
97. MS - Military Standardization Documents
98. MSS - Manufacturer's Standardization Society of the Valve and Fittings Industry
99. NAA - National Arborist Association
100. NAAMM - National Association of Architectural Metal Manufacturers
101. NAAMM - North American Association of Mirror Manufacturers
102. NACE - NACE International
103. NAIMA - North American Insulation Manufacturers Association
104. NBHA - National Builders Hardware Association
105. NBGQA - National Building Granite Quarries Association, Inc.
106. NBS - National Bureau of Standards
107. NCMA - National Concrete Masonry Association
108. NCTA - National Cable Television Association
109. NCRP - National Council on Radiation Protection and Measurement
110. NEBB - National Environmental Balancing Bureau
111. NECA - National Electrical Contractors Association
112. NELMA - Northeastern Lumber Manufacturer's Association
113. NEMA - National Electrical Manufacturers' Association
114. NETA - International Electrical Testing Association
115. NFPA - National Fire Protection Association
116. NFRC - National Fenestration Rating Council
117. NHLA - National Hardwood Lumber Association
118. NIBS - National Institute of Building Sciences
119. NIST - National Institute of Standards and Technology
120. NRMCA - National Ready Mixed Concrete Association
121. NLA - National Lime Association

**SECTION 01400
QUALITY REQUIREMENTS**

122. NLGA - National Lumber Grades Authority
123. NOFMA - National Oak Flooring Manufacturers Association
124. NPCA - National Paint and Coatings Association
125. NRCA - National Roofing Contractors Association
126. NRMCA - National Ready Mixed Concrete Association
127. NSF - NSF International
128. NSPI - National Spa and Pool Institute
129. NTMA - National Terrazzo and Mosaic Association
130. NUCA - National Utility Contractors Association
131. NWMA - National Woodwork Manufacturer's Association
132. NWWDA - National Wood Window and Door Association
133. OSHA - U. S. Department of Labor, Occupational Safety and Health Administration
134. PCA - Portland Cement Association
135. PCI - Precast/Prestressed Concrete Institute
136. PDCA - Painting and Decorating Contractors of America
137. PDI - Plumbing and Drainage Institute
138. PEI - Petroleum Equipment Institute
139. PFI - Pipe Fabrication Institute
140. PS - Product Standard
141. PTI - Post Tensioning Institute
142. RCSC - Research Council on Structural Connections
143. RIS - The Redwood Inspection Service
144. RUS - U. S. Department of Agriculture, Rural Utilities Services
145. SAE - Society of Automotive Engineers
146. SAMA - Scientific Apparatus Makers Association
147. SBCCI - Southern Building Code Congress International
148. SCMA - Southern Cypress Manufacturers Association
149. SCTE - Society of Cable Telecommunications Engineers
150. SDI - Steel Deck Institute
151. SDI - Steel Door Institute
152. SIGMA - Sealed Insulating Glass Manufacturers Association
153. SJI - Steel Joist Institute
154. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association
155. SPIB - Southern Pine Inspection Bureau

**SECTION 01400
QUALITY REQUIREMENTS**

- 156. SPRI - Single Ply Roofing Institute
- 157. SSPC - The Society for Protective Coatings
- 158. STI - Steel Tank Institute
- 159. SWI - Steel Window Institute
- 160. SWRI - Sealant, Waterproofing, and Restoration Institute
- 161. TCA - Tile Council of America, Inc.
- 162. TEMA - Tubular Exchanger Manufacturers Association
- 163. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance
- 164. TMA - The Masonry Society
- 165. TPI - Truss Plate Institute
- 166. TPI - Turfgrass Producers International
- 167. UL - Underwriters' Laboratories, Inc.
- 168. WCLIB - West Coast Lumber Inspection Bureau
- 169. WDMA - Window and Door Manufacturers Association
- 170. WH - Intertek Testing Services, Warnock Hersey Listing Services
- 171. WIC - Woodwork Institute of California
- 172. WWPA - Western Wood Products Association

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Verify that utility services are available, of the correct characteristics, and in the correct locations.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.

**SECTION 01400
QUALITY REQUIREMENTS**

- C. Apply manufacturer required or recommended substrate.

3.03 FIELD PERFORMANCE TESTS

- A. After system or equipment necessary for operation of Work is in operating condition, CONTRACTOR shall supervise operation of equipment or system for period sufficient to assure proper functioning, and make necessary observations, investigations, and adjustments.
- B. Notify ENGINEER when Work is considered to be complete, in operating condition, and ready for inspection and tests.
- C. ENGINEER will conduct tests it deems necessary to determine if equipment or system functions properly.
- D. If equipment or system fails to function properly, or guaranteed performance is not indicated, CONTRACTOR shall make necessary corrections, including replacement, at no cost to OWNER, and after such corrections are completed, demonstrate to ENGINEER that equipment or system functions properly and guaranteed performance is obtainable.

- END OF SECTION -

**SECTION 01500
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities:
 - 1. Temporary electricity.
 - 2. Temporary heating and ventilation.
 - 3. Telephone service.
 - 4. Temporary water service.
 - 5. Temporary sanitary facilities.
- B. Construction facilities:
 - 1. Special tools.
 - 2. Explosives and blasting.
 - 3. Sheds.
- C. Temporary controls:
 - 1. Barriers.
 - 2. Protection of the Work.
 - 3. Debris control.
 - 4. Pollution control.
- D. Removal of utilities, facilities, and controls.

1.02 ELECTRICITY, LIGHTING

- A. Provide temporary construction power, wiring and lighting as required during construction.
- B. Illumination levels: In accordance with OSHA requirements for construction lighting.
- C. Equipment and materials need not be new.
- D. Temporary wiring shall be sized and fused in accordance with NEC requirements.

1.03 HEAT, VENTILATION

- A. Provide as required to maintain specified conditions for construction operations, to protect materials and finishes from damage due to temperature or humidity.
- B. Prior to operation of permanent facilities for temporary purposes, verify that installation is approved for operation, and that filters are in place.

**SECTION 01500
TEMPORARY FACILITIES AND CONTROLS**

- C. Provide ventilation of enclosed areas to cure materials, to disperse humidity, and to prevent accumulations of dust, fumes, vapors, or gases.

1.04 TELEPHONE SERVICE

- A. Provide telephone service to the field office or cellular phone service and number for field superintendent.

1.05 WATER

- A. All water required for and in connection with the Work to be performed shall be furnished by and at the expense of the CONTRACTOR.
- B. CONTRACTOR solely responsible for obtaining all applicable permits and paying all fees associated with obtaining water.
- C. CONTRACTOR shall provide all necessary tools, hose, and pipe, or otherwise transport the water to the point of use, and shall make its own arrangements as to the amount of water required and the time when the water will be needed.

1.06 SANITARY FACILITIES

- A. CONTRACTOR shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services.
1. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period.
 2. If toilets of the chemically treated type are used, at least one toilet shall be furnished for each 20 persons.

1.07 SPECIAL TOOLS

- A. Provide special tools necessary.

1.08 BARRIERS

- A. Provide as required to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades as required by governing authorities for rights of way and for access to existing facilities.

1.09 PROTECTION OF INSTALLED WORK

- A. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.
- B. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors from traffic, movement of heavy objects, and storage.

**SECTION 01500
TEMPORARY FACILITIES AND CONTROLS**

- C. Prohibit traffic and storage on waterproofed and roofed surfaces.

1.10 DEBRIS CONTROL

- A. Keep areas free from extraneous debris; keep work area in neat, clean, and safe condition.
- B. Initiate and maintain specific program to prevent accumulation of debris at site, in storage and parking areas, and along access roads and haul routes, as follows:
 1. Provide containers for deposit of debris.
 2. Prohibit overloading of trucks to prevent spillage on access and haul routes.
 3. Perform periodic inspections to enforce these requirements.
- C. Schedule periodic collection and disposal of debris and provide additional collection and disposal of debris whenever periodic schedule is inadequate to prevent accumulation.
- D. If CONTRACTOR fails to clean up as provided in Contract Documents, OWNER may do so and cost thereof will be charged to CONTRACTOR.

1.11 POLLUTION CONTROL

- A. Prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations, including equipment, personnel and emergency measures required to contain any spillage, and to remove contaminated soils or liquids.
- B. After obtaining proper approvals, excavate and dispose of contaminated earth off site, and replace with suitable compacted fill.
- C. Take special precautions to prevent harmful substances from entering public waters.
- D. Prevent disposal of wastes, effluents, chemicals or other substances adjacent to washes, or in sanitary or storm sewers.
- E. Control atmospheric pollutants to prevent toxic concentrations of chemicals, and to prevent harmful dispersal of pollutants into atmosphere.
- F. Project is located in Mohave County, Arizona.
 1. Contact Arizona Department of Environmental Quality (Air Pollution Control Division) regarding special considerations concerning air quality requirements in the State.
 2. Compliance with rules, regulations, special stipulations and laws pertaining to air quality shall be Contractor's responsibility and cost thereof shall be considered in Contract lump sum price.

1.12 EXPLOSIVES AND BLASTING

- A. Use of explosives on Work will not be permitted without written approval of OWNER pursuant to review of CONTRACTOR supplied blasting program.

1.13 CLEANING DURING CONSTRUCTION

**SECTION 01500
TEMPORARY FACILITIES AND CONTROLS**

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.
- B. Clean interior areas prior to start of finish Work, maintain areas free of dust and other contaminants during finishing operations.

1.14 SHEDS

- A. Storage sheds for tools, materials, and equipment: Weathertight with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.15 REMOVAL

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Restore existing facilities used during construction to original condition.

1.16 SITE SECURITY

- A. The Site shall remain secure at all times.
- B. The CONTRACTOR shall be solely responsible for keeping it's equipment and materials secure. Temporary fencing may be constructed at CONTRACTOR'S option and expense.
- C. The CONTRACTOR shall have an established program or policy for performing employee background checks and shall perform these checks for all employees working on this Project. Any employees deemed a security risk shall immediately be removed from the Site by the CONTRACTOR.
- D. The CONTRACTOR shall identify a single person (Security Coordinator) in charge of site security and provide a name and 24-hour access number. This individual shall be responsible for coordinating all security activities and making sure all security requirements are met.
- E. CONTRACTOR shall submit a list of employees that will work onsite prior to beginning any Work. The list shall be updated and resubmitted when any changes are made to the CONTRACTOR'S work force.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01530
PROTECTION OF EXISTING FACILITIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protect existing utilities and improvements not designated for removal.
- B. Restore damaged or temporarily relocated utilities and improvements to condition equal to or better than they were prior to such damage or temporary relocation.
- C. Verify exact locations and depths of utilities shown and make exploratory excavations of utilities that may interfere with Work.
 1. Perform exploratory excavations as soon as practicable after award of Contract and in sufficient time in advance of construction to avoid possible delays to Work.
 2. When exploratory excavations show utility location as shown to be in error, notify ENGINEER.
- D. Number of exploratory excavations required shall be sufficient to determine alignment and grade of existing utilities.

1.02 RIGHTS OF WAY

- A. Access to lands or rights of way, for Work will be provided by OWNER.
 1. Nothing contained in Contract Documents shall be interpreted as giving CONTRACTOR exclusive occupancy of lands or rights of way provided.
 2. Additional lands or rights of way required for construction operations shall be provided by CONTRACTOR at his own expense, but only approved and conditioned by the OWNER.
- B. Do not enter nor occupy with men, equipment, or materials, lands outside rights of way or easements shown.

1.03 PROTECTION OF STREET OR ROADWAY MARKERS

- A. Do not destroy, remove, or otherwise disturb existing survey markers or other existing street or roadway markers without proper authorization.
- B. Start no excavation until survey or other permanent marker points that will be disturbed by construction operations have been properly referenced for easy and accurate restoration. Restoration will be by the OWNER.
- C. Notify OWNER of time and location that work will be done, 1 week in advance of construction to avoid delay due to waiting for survey points to be satisfactorily referenced for restoration.
- D. Survey markers or points disturbed by CONTRACTOR without proper authorization by OWNER will be restored by OWNER at CONTRACTOR'S expense.

1.04 CONSTRUCTION INTERFERENCES

**SECTION 01530
PROTECTION OF EXISTING FACILITIES**

- A. CONTRACTOR'S responsibilities regarding existing utilities and construction interferences shall be in accordance with Subsection 105.06 of Uniform Standard Specifications for Public Works' Construction, Clark County Area, Nevada.
- B. Construction interferences include:
 - 1. Utility or service connections within limits of excavation or over excavation required for Work.
 - 2. Utility or service connections located in space which will be required by Work.
 - 3. Utility or service connections required to be disturbed or removed to permit construction as specified under Contract.
- C. Disturb or remove connections only with approval of OWNER and following notification to OWNER of interfering utility or service connection.
- D. Promptly reconstruct utility or service connections removed or otherwise disturbed in original or other authorized location in condition at least as good as prior to such removal or disturbance, subject to inspection of utilities' owners.
- E. CONTRACTOR'S responsibility to remove or replace shall apply even if damage or destruction occurs after backfilling.
- F. Immediately notify owner of utility or service connection damage, or if destruction occurs or is discovered.
- G. During performance of Work, owner of utility affected by Work shall have right to enter when necessary upon any portion of Work for purpose of maintaining service and of making changes in or repairs to utility.
- H. CONTRACTOR shall submit plans for approval of relocation, repair or replacement of utilities to the agency having jurisdiction over utility or service connection to authorize or otherwise provide for its removal, relocation, protection, support, repair, maintenance, or replacement.
- I. Exercise extreme care not to damage existing utilities and/or new and existing facilities which do not physically constitute construction interference. CONTRACTOR shall be responsible for costs of repair and/or replacement of new or existing facilities damaged by construction operations, as determined by OWNER.
- J. Contact "CALL BEFORE YOU DIG" not less than 48 hours prior to starting any excavation. Notify by telephone and comply with instructions received; toll free number is 1-800-227-2600.
 - 1. Utility companies may not be members of USA System and, therefore, not automatically contacted by above referenced telephone number.
 - 2. CONTRACTOR shall be responsible for making himself aware of utility company facilities not reported by USA System, and shall bear damages stemming from repair or delay costs or other expenses resulting from unanticipated discovery of underground utilities.
 - 3. Notify the following utilities at least 2 working days in advance of commencement of Work at site, to examine construction site and mark location of utilities' respective facilities. Verify that each utility has responsibly responded to notification.

**SECTION 01530
PROTECTION OF EXISTING FACILITIES**

4. If above telephone numbers are changed, CONTRACTOR is not relieved of responsibility for notifying various utilities.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01600
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.02 PRODUCTS

- A. Provide products of qualified manufacturers suitable for intended use. Provide products of each type by a single manufacturer unless specified otherwise.

1.03 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.04 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide off site storage and protection when site does not permit on site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign matter.

**SECTION 01600
PRODUCT REQUIREMENTS**

- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.05 PRODUCT OPTIONS

- A. Products specified by reference standards or by description only: Any product meeting those standards or description.
- B. Products specified by naming one or more manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.06 PRODUCT SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- B. Substitutions may be considered when a product becomes unavailable through no fault of the CONTRACTOR.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that the BIDDER:
 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the Substitution as for the specified product.
 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to OWNER.
 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 5. Will reimburse OWNER and ENGINEER for review or redesign services associated with re-approval by authorities.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution submittal procedure:
 1. Submit 3 copies of request for Substitution for consideration. Limit each request to one proposed Substitution.

**SECTION 01600
PRODUCT REQUIREMENTS**

2. Submit Shop Drawings, Product Data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. ENGINEER will notify CONTRACTOR in writing of decision to accept or reject request.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01740
CLEANING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disposal requirements.
- B. Materials.
- C. Cleaning during construction.
- D. Dust control
- E. Final cleaning.

1.02 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal requirements to comply with codes, ordinances, regulations, and anti pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.
- C. Use cleaning materials only on surface recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 CLEANING DURING CONSTRUCTION

- A. Execute periodic cleaning to keep Work, site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide on site containers for collection waste materials, debris, and rubbish.
- C. Remove waste materials, debris, and rubbish from site periodically and dispose of at legal disposal areas away from site.

3.02 DUST CONTROL

- A. Clean interior spaces prior to start of finish painting and continue cleaning on an as needed basis until painting is finished.

**SECTION 01740
CLEANING**

- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
- 3.03 FINAL CLEANING
- A. Employ skilled workers for final cleaning.
 - B. Remove grease, mastic, adhesives, dust, dirt stains, fingerprints, labels, and other foreign materials from sight exposed interior and exterior surfaces, as well as all tools, appliances, construction equipment and machinery, and surplus materials.
 - C. Wash and shine glazing and mirrors.
 - D. Polish glossy surfaces to clear shine.
 - E. Ventilating systems:
 - 1. Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds, so as to leave site ready for occupancy by OWNER, and restore those portions of site not designated for alteration by Contract Documents to their condition as of beginning of Work.
 - G. Prior to final completion, or OWNER occupancy, CONTRACTOR shall conduct inspection of sight exposed interior and exterior surfaces, and all work areas, to verify that entire Work is clean.

- END OF SECTION -

**SECTION 01770
CLOSEOUT PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Substantial completion.
- B. Final completion.
- C. Reinspection fees.
- D. Closeout submittals.
- E. Adjustment of accounts.
- F. Application for final payment.

1.02 SUBSTANTIAL COMPLETION

- A. When CONTRACTOR considers Work is substantially complete, submit written notice, with list of items to be completed or corrected.
- B. Within reasonable time, OWNER and ENGINEER will inspect to determine status of completion.
- C. Should OWNER or ENGINEER determine that Work is not substantially complete; it will promptly notify CONTRACTOR will be promptly notified in writing, giving reasons therefore.
- D. CONTRACTOR shall remedy deficiencies, and send second written notice of substantial completion, and OWNER and ENGINEER will reinspect Work.
- E. When OWNER and ENGINEER determine that Work is substantially complete, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.

1.03 FINAL COMPLETION

- A. When CONTRACTOR considers Work is complete, it shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents, and deficiencies listed with Certificate of Substantial Completion have been corrected.
 - 4. Equipment and systems have been tested in presence of OWNER'S Representative and are operational.
 - 5. Work is complete and ready for final inspection.
- B. OWNER and ENGINEER will inspect to verify status of completion with reasonable promptness.
- C. Should OWNER or ENGINEER consider that Work is incomplete or defective, CONTRACTOR will be promptly notified in writing, listing incomplete or defective Work.

**SECTION 01770
CLOSEOUT PROCEDURES**

- D. CONTRACTOR shall take immediate steps to remedy deficiencies and send second written certification that Work is complete, and OWNER and ENGINEER will reinspect Work.
- E. When OWNER and ENGINEER find Work is acceptable, it will consider closeout submittals.

1.04 REINSPECTION FEES

- A. Should ENGINEER perform reinspections due to failure of Work to comply with claims made by CONTRACTOR, OWNER will compensate ENGINEER for such additional services and deduct amount of such compensation from final payment to CONTRACTOR.

1.05 CLOSEOUT SUBMITTALS

- A. Evidence of compliance with requirements of governing authorities.
- B. Certificate of occupancy.
- C. Project record documents: In accordance with Section 01780.
- D. Operation and maintenance data, instructions to OWNER'S personnel: In accordance with Section 01785.
- E. Warranties and Bonds: In accordance with Section 01780.
- F. Evidence of payment and release of liens: In accordance with General and Supplementary Conditions.
- G. Consent of Surety to final payment.
- H. Certificates of insurance for products and completed operations: In accordance with Supplementary Conditions.

1.06 ADJUSTMENT OF ACCOUNTS

- A. Submit final statement of accounting, reflecting adjustments to Contract Price:
 - 1. Original Contract Price.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders.
 - b. Allowances.
 - c. Unit prices.
 - d. Deductions for uncorrected Work.
 - e. Penalties and bonuses.
 - f. Deductions for liquidated damages.
 - g. Deductions for reinspection payments.
 - h. Other adjustments.

**SECTION 01770
CLOSEOUT PROCEDURES**

3. Total Contract Price, as adjusted.
 4. Previous payments.
 5. Sum remaining due.
- B. ENGINEER will issue final Change Order, reflecting approved adjustments to Contract Price not previously made by Change Orders.

1.07 APPLICATION FOR FINAL PAYMENT

- A. Submit Application for Final Payment in accordance with procedures and requirements in conditions of Agreement.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01780
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Maintenance of documents and samples.
- B. Marking devices.
- C. Recording.
- D. Submittal.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Maintain at Site for OWNER one record copy of:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to Agreement.
 - 5. ENGINEER'S Instruction to CONTRACTOR or written instructions.
 - 6. Reviewed Shop Drawings and Samples.
 - 7. Field test records.
 - 8. Construction photographs.
- B. Store documents and Samples in CONTRACTOR'S field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinet or secure storage space for storage of Samples.
- C. File documents and Samples in accordance with Construction Specifications Institute (CSI) format.
- D. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- E. Make documents and Samples available at all times for reference by ENGINEER.

1.03 MARKING DEVICES

- A. Provide felt tip marking pens for recording information in color code designated by ENGINEER.

1.04 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.

**SECTION 01780
CLOSEOUT SUBMITTALS**

- B. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.
- C. Drawings shall be legibly marked to record actual construction:
 1. Depths of various elements of foundation in relation to finish first floor datum.
 2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 3. Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
 4. Field changes of dimension and detail.
 5. Changes made by Instruction to CONTRACTOR or by Change Order.
 6. Details not on original contract Drawings.
- D. Specifications and Addenda shall be legibly marked to record:
 1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 2. Changes made by Instruction to CONTRACTOR or by Change Order.

1.05 SUBMITTAL

- A. At Agreement close out, deliver record documents to ENGINEER for OWNER.
- B. Accompany submittal with transmittal letter in duplicate, containing:
 1. Date.
 2. Project title and number.
 3. CONTRACTOR'S name and address.
 4. Title and number of each record document.
 5. Signature of CONTRACTOR or its authorized representative.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Operating and maintenance data requirements.
- B. Quality assurance.
- C. Form of submittals.
- D. Content of manual.
- E. Manual for materials and finishes.
- F. Manual for equipment and systems.
- G. Submittal schedule.
- H. Instruction of OWNER'S personnel.

1.02 OPERATING AND MAINTENANCE DATA REQUIREMENTS

- A. Compile product data and related information appropriate for OWNER'S maintenance and operation of products furnished under Agreement.
- B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of Specifications.
- C. Instruct OWNER'S personnel in maintenance of products and in operation of equipment and systems.

1.03 QUALITY ASSURANCE

- A. Preparation of data shall be done by personnel:
 - 1. Trained and experienced in maintenance and operation of described products.
 - 2. Familiar with requirements of this section.
 - 3. Skilled as technical writers to extent required to communicate essential data.
 - 4. Skilled as draftsmen competent to prepare required drawings.

1.04 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by OWNER'S personnel.
- B. Format:
 - 1. Size 8 1/2" x 11".
 - 2. Paper: 20 lb minimum, white, for typed pages.

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

3. Text: Manufacturer's printed data, or neatly typewritten.
4. Drawings:
 - a. Provide reinforced punched binder tab, bind in with text.
 - b. Fold larger drawings to size of text pages.
5. Provide flyleaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of product, and major component parts of equipment.
 - b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS." List:
 - a. Title of Project.
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in manual.
7. Binders:
 - a. Commercial quality 3 ring binders with durable and cleanable plastic covers.
 - b. Maximum ring size: 1".
 - c. When multiple binders are used, correlate data into related consistent groupings.
8. Electronic O&M Manual:
 - a. Electronic copy on CD.
 - b. All text documents and drawings shall be in .PDF format.

1.05 CONTENT OF MANUAL

- A. Neatly typewritten table of contents for each volume, arranged in systematic order.
 1. CONTRACTOR, name of responsible principal, address, and telephone number.
 2. List of each product required to be included, indexed to content of volume.
 3. List, with each product, name, address, and telephone number of:
 - a. Subcontractor or installer.
 - b. Maintenance contractor, as appropriate.
 - c. Identify area of responsibility of each.
 - d. Local source of supply for parts and replacement and list of recommended spare parts.
 4. Identify each product by product name and other identifying symbols as set forth in Contract Documents, including nameplate information and shop order numbers for each item of equipment furnished.

B. Product data:

1. Include only those sheets which are pertinent to specific product.
2. Annotate each sheet to:

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

- a. Clearly identify specific product or part installed.
 - b. Clearly identify data applicable to installation.
 - c. Delete references to inapplicable information.
- C. Drawings:
- 1. Supplement product data with Drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.
 - 2. Coordinate Drawings with information in Project record documents to assure correct illustration of completed installation.
 - 3. Do not use Project record documents as maintenance Drawings.
- D. Written text, as required to supplement product data for particular installation.
- 1. Organize in consistent format under separate headings for different procedures.
 - 2. Provide logical sequence of instructions for each procedure.
- E. Copy of each warranty, Bond, and service contract issued.
- 1. Provide information sheet for OWNER'S personnel, giving:
 - a. Proper procedures in event of failure.
 - b. Instances which might affect validity of warranties or Bonds.

1.06 MANUAL FOR MATERIALS AND FINISHES

- A. Submit 7 copies of complete manual in final form.
 - 1. 5 hard copies.
 - 2. 2 electronic copies on CD (1 to the OWNER, 1 to the ENGINEER).
- B. Contents, for moisture protection and weather exposed products:
 - 1. Manufacturer's data, giving full information on products.
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
 - 2. Instructions for inspection, maintenance, and repair.
- C. Additional requirements for maintenance data: Respective sections of Specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit 7 copies of complete manual in final form.
 - 1. 5 hard copies.

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

2. 2 electronic copies on CD (1 to the OWNER, 1 to the ENGINEER).
- B. Contents, for each unit of equipment and system, as appropriate:
 1. Description of unit and component parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 2. Operating procedures:
 - a. Startup, break in, routine, and normal operating instructions.
 - b. Regulation, control, stopping, shutdown, and emergency instructions.
 - c. Summer and winter operating instructions.
 - d. Special operating instructions.
 3. Maintenance procedures:
 - a. Routine operations.
 - b. Guide to "trouble shooting."
 - c. Disassembly, repair, and reassembly.
 - d. Alignment, adjusting, and checking.
 4. Servicing and lubrication schedule: List of lubricants required.
 5. Manufacturer's printed operating and maintenance instructions.
 6. Description of sequence of operation by control manufacturer.
 7. Original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
 - a. Predicted life of parts subject to wear.
 - b. Items recommended to be stocked as spare parts.
 8. As installed control diagrams by controls manufacturer.
 9. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 10. Other data as required under pertinent sections of Specifications.
- C. Content, for each electrical and electronic system, as appropriate.
 1. Description of system and component parts:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, and tests.
 - c. Complete nomenclature and commercial number of replacement parts.
 2. Circuit directories of panelboards:
 - a. Electrical service.

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

- b. Controls.
 - c. Communications.
 - 3. As installed color coded wiring diagrams.
 - 4. Operating procedures:
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.
 - 5. Maintenance procedures:
 - a. Routine operations.
 - b. Guide to "trouble shooting."
 - c. Disassembly, repair, and assembly.
 - d. Adjustment and checking.
 - 6. Manufacturer's printed operating and maintenance instructions.
 - 7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 - 8. Other data as required under pertinent sections of Specifications.
- D. Prepare and include additional data when need for such data becomes apparent during instruction of OWNER'S personnel.
- E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.08 SUBMITTAL SCHEDULE

- A. Preliminary draft:
 - 1. Provide 2 copies with equipment.
 - 2. Submit 2 copies to OWNER and ENGINEER.
 - 3. Submit 2 copies to ENGINEER of proposed formats and outlines of contents prior to start of Work. ENGINEER will review draft and return 1 copy with comments.
- B. Submit one copy of completed data in final form 15 days prior to final inspection or acceptance. Copy will be returned after final inspection or acceptance, with comments.
- C. Submit specified number of copies of approved data in final form 10 days after final inspection or acceptance.

1.09 INSTRUCTION CITY'S PERSONNEL

- A. Prior to final inspection or acceptance, fully instruct CITY'S designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

**SECTION 01785
OPERATING AND MAINTAINENCE DATA**

- B. Manual for equipment and systems shall constitute basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

- END OF SECTION -

SECTION 02200 - EARTHWORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform all earthwork indicated and required for construction of the WORK, complete and in place, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards:

Section 1926.650-652	OSHA Safety and Health Standards for Construction
Report No. 5657-1000	Notification on Mine Opening (MSHA)
Report No. 521-160 #3	Notification on Mine Closing (MSHA)
ASTM C 127	Test Method for Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C 131	Test Method for Resistance to Gradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 150	Standard Test Method for Fineness of Portland Cement by the Turbidimeter
ASTM D 75	Practice for Sampling Aggregates
ASTM D 422	Method for Particle-Size Analysis of Soils
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2,700 kN-m/m ³)
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2487	Test Method for Classification of Soil for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place By Nuclear Methods (Shallow Depth)

ASTM D 4253	Test Methods for Maximum Index Density of Soils using a Vibratory Table
ASTM D 4254	Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4832	Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinder
ASTM D 5971	Standard Practice for Sampling Freshly Mixed Controlled Low Strength Material
ASTM D 6023	Standard Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)
ASTM D 6024	Standard Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application
ASTM D 6103	Standard Test Method for Flow Consistency of Controlled Low Strength Material (CLSM)
ASTM G 57	Standard Test Method for Field Method of Resistivity By the Four Electrode Method
N.B.S.	Building Science Series 127 "Recommended technical Provisions for Construction Practice in Shoring and Sloping Trenches and Excavations".
STANDARD METHOD 4500 C	Test Method for Determination of Chloride Content by Potentiometric Methods
STANDARD METHOD 4500 E	Test Method for Determination of Water Soluble Sulfate Concentration by Turbidimetric Methods
EPA 150.1	Test Method for Determination of Concentration of Hydrogen Ions in Solution

1.3 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR's attention is directed to the provisions of Subpart P, 29 CFR, Section 1926.652 of the OSHA Safety and Health Standards for Construction which relate to protection of employees in excavations.

- B. Submit samples of all materials proposed to be used in the work in accordance with the requirements in Section 01300 - Contractor Submittals. Sample sizes shall be as determined by the testing laboratory.
- C. If CONTRACTOR proposes shoring, sheeting, and bracing methods submit complete design calculations and working drawings which have been prepared, signed, and sealed by a Licensed Professional Engineer in the discipline of Structural Engineering and registered in the State of Arizona, before starting excavation. CONSTRUCTION MANAGER's review of calculations and working drawings will be limited to confirming that the design was prepared by a Licensed Professional Engineer.

PART 2 -- PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

- A. General: Fill, backfill, and embankment materials shall be suitable material.
- B. Suitable Materials: Suitable material is defined as selected or processed clean, well graded earth material, sands and gravel free of excessive fines, less than 20 percent rock and boulders larger than 4 inches, grass, roots, brush, vegetation, or other deleterious materials.
- C. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 1 inch.
- D. Suitable materials may be obtained from onsite excavations, may be processed onsite materials, or may be imported. If imported materials are required by this Section or to meet the quantity requirements of the Project, provide the imported materials at no additional expense to the OWNER.
- E. The following types of suitable materials are defined:
 - 1. Type A (Gravel): Crushed rock or gravel with the following gradation:
1" Sieve – 100%, 3/4" Sieve – 25%-35%, 1/2" Sieve – 0%-10%
 - 2. Type B (Aggregate Base Course): Conforming to the following gradation:
1" Sieve – 100%, 1/2" Sieve – 79%-91%, No. 4 Sieve – 49%-61%,
No. 16 Sieve – 27%-35%, No. 200 Sieve – 7%-11%.
 - 3. Type C (Pipe Zone Fill): Use Type B (Aggregate Base Course)

2.2 UNSUITABLE MATERIAL

- A. Unsuitable materials include but are not limited to the materials listed below.
 - 1. Soils which, when classified under ASTM D 2487 - Classification of Soils for Engineering Purposes, fall in the classifications of Pt, OH, CH, MH, or OL.

2. Soils which cannot be compacted sufficiently to achieve the density indicated for the intended use.
3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
4. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the existing onsite soils.

2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

- A. Use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.
- B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, notify the CONSTRUCTION MANAGER immediately. In case of conflict between types of pipe embedment backfills, use the agency-specified backfill material if that material provides a greater degree of support to the pipe, as determined by the CONSTRUCTION MANAGER. In case of conflict between types of trench or final backfill types, use the agency-specified backfill material if that material provides the greater in-place density after compaction.
- C. Fill and backfill types shall be used in accordance with the following provisions:
 1. Pipe zone backfill shall consist of Type B.
 3. Trench zone backfill for pipelines shall be Type B. Native material may be substituted subject to CONSTRUCTION MANAGER approval.
 4. Backfill around structures shall be Type B.
 5. Backfill materials beneath structures shall be Type B
 6. Backfill used to replace pipeline trench over excavation shall be a layer of Type A material with filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.

2.4 PIPELINE MARKING TAPE

- A. Metallic Tape: Tape shall be minimum 5.5 mils thick aluminum foil imprinted on one side, encased in high visibility inert polyethylene jacket. Tape shall be 12 inches wide. Imprinted lettering shall be 1 inch tall, permanent black. Joining clips shall be manufacturer's standard tin or nickel coated. Tape shall be as manufactured by Reef Industries (Terra "D"), Allen (Detectatape), or equal.
- B. Plastic Tape: Tape shall be minimum 4-mil thick polyethylene which is impervious to alkalis, acids, and chemicals and solvents which are likely in the soil. Tape shall be

12 inches wide and lettering shall be 1-inch tall permanent black on a blue background. Tape shall be manufactured by Reef Industries (Terra Tape), Allen (Markline), or equal.

- C. Lettering shall read as follows:

Over the pipe: "WATER LINE BURIED BELOW."

2.5 MATERIALS TESTING

- A. All soils testing of samples submitted by the CONTRACTOR will be done by a testing laboratory of the OWNER's choice and at the CONTRACTOR's expense. At its discretion, the CONSTRUCTION MANAGER may request that the CONTRACTOR supply samples for testing of any material used in the work. The frequency of material tests shall be as follows or at CONSTRUCTION MANAGER's option:
1. Trench backfill, crushed rock: 1 test per material type, each 5,000 cubic yards. Tested for Maximum Density and Optimum Moisture, Sieve Analysis, Plasticity Index, and Liquid Limit.
 2. The frequency of Field Compaction Tests by the CONSTRUCTION MANAGER will be determined by the CONSTRUCTION MANAGER.
 3. When the characteristics of backfill material change, additional tests may be requested at the CONSTRUCTION MANAGER's option.
 4. Structural Backfill: Shall be tested 1 per material type or 5000cy.
- B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Method for Particle-Size Analysis of Soils.
- C. Determination of sand equivalent value will be performed using ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- D. Unified Soil Classification System: References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487. The CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.
- E. The testing for chloride, sulfate, resistivity, and pH will be done by a testing laboratory of the OWNER's choice and at the CONTRACTOR's expense.

PART 3 -- EXECUTION

3.1 EXCAVATION - GENERAL

- A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including rock and all obstructions of any nature that would interfere with the proper execution and completion of the WORK. The removal of said materials shall conform to the lines and grades indicated or ordered. Unless otherwise indicated, the entire construction site shall be

stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. Furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations. Excavations shall be sloped or otherwise supported in a safe manner in accordance with safety requirements of the State of Arizona Occupational Safety and Health Stds. and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

- B. Removal and Exclusion of Water: Remove and exclude water, including storm water, groundwater, irrigation water, and wastewater, from all excavations. Dewatering wells, well points, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least 2 feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing has been completed. Water removal operations shall include control measures or treatment required by permits.

3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

- A. Excavation Beneath Structures and Embankments: Except where otherwise indicated for a particular structure or ordered by the CONSTRUCTION MANAGER, excavation shall be carried to the grade of the bottom of the footing or slab. Where indicated or ordered, areas beneath structures or fills shall be over excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where the slope of subgrade exceeds 5 horizontal to 1 vertical, the native material shall be benched. When such over excavation is indicated, both over excavation and subsequent backfill to the required grade shall be performed. When such over excavation is not indicated but is ordered by the CONSTRUCTION MANAGER, such over excavation and any resulting backfill will be paid for under the unit price bid item. After the required excavation or over excavation has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain a minimum of 95 percent of maximum density with moisture content within plus or minus 2 percent of the optimum moisture content.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

- A. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches.
- B. Trench Bottom: The bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe zone. Excavations for pipe bells shall be made as required. A minimum of 90 percent of maximum density compaction is required with moisture content within plus or minus 2 percent of the optimum moisture content.
- C. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill

at the end of each day. The above requirements for backfilling or use of steel plate may be waived by the CONSTRUCTION MANAGER in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting safety requirements shall be provided and maintained.

- D. Trench Over excavation: Where trenches are indicated to be over excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade of the bottom of the pipe bedding.
- E. Over excavation: When ordered by the CONSTRUCTION MANAGER, whether indicated on the Drawings or not, trenches shall be over-excavated beyond the depth and/or width shown. Such over-excavation shall be to the dimensions ordered. The trench shall then be backfilled to the grade of the bottom of the pipe bedding. Over-excavation less than 6 inches below the limits on the Drawings shall be done at no increase in cost to the OWNER. When the over-excavation ordered by the CONSTRUCTION MANAGER is 6 inches or greater below the limits shown, or wider, additional payment will be made by Change Order. When the over-excavation is less than 6", the work shall be performed at no increase in cost to the OWNER.
- F. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.
- G. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield so that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls. If the trench walls cave in or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring.

3.4 OVER EXCAVATION NOT ORDERED OR INDICATED

- A. Any over-excavation carried below the grade ordered or indicated, shall be backfilled to the required grade with the indicated material and compaction. Such work shall be performed at no additional cost to the OWNER.

3.5 EXCAVATION IN VICINITY OF TREES

- A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the CONSTRUCTION MANAGER. Trees shall be supported during excavation by any means previously reviewed and accepted by the CONSTRUCTION MANAGER.

3.6 BACKFILL - GENERAL

- A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be

placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

- B. Except for drainrock materials being placed in over excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.
- C. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally. Do not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.
- D. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. All materials disturbed from their intact condition that are 4 inches or larger in least dimension or aggregates of soil material thicker than 4 inches shall be removed from the excavation walls and base prior to placing pipe or any backfill material. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

3.7 PLACING AND SPREADING OF BACKFILL MATERIALS

- A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that the depth of each uncompacted layer shall not exceed 8 inches in thickness.
- B. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved. Proper moisture content plus or minus 2% of optimum moisture content.
- C. Where the backfill material moisture content is too high to permit the indicated degree of compaction the material shall be dried or mixed with drier material until the moisture content is satisfactory, plus or minus 2% of optimum for that soil class.

3.8 COMPACTION OF EARTH FILL, BACKFILL, AND EMBANKMENT MATERIALS

- A. Each layer of backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.
- B. Equipment weighing more than 10,000 pounds shall not be used closer to structure walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.
- C. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least

- 2.5 feet of compacted backfill over the top of pipeline, compaction equipment exerting no more than 3,500 pounds per square foot may be used to complete the trench backfill.
- D. Compaction Requirements: The following minimum compaction test requirements shall be in accordance with ASTM D 1557. Where agency or utility company requirements govern, the highest compaction standards shall apply.

<u>Location or Use of Fill</u>	<u>Maximum Density</u>
Pipe Zone aggregate material	90
Trench Zone backfill or embankments and fills (including disposal site)	90
Final backfill, beneath paved areas or structures and aggregate base under paving	95

3.9 PIPE AND UTILITY TRENCH BACKFILL

- A. Pipe Zone:
1. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe and a plane at a point 12 inches above the top surface of the pipe. The bedding is defined as that portion of pipe zone backfill material between the bottom of the trench and the bottom of the pipe. The embedment is defined as that portion of the pipe zone material between the bedding and a plane at a point 12 inches above the top surface of the pipe.
 2. After compacting the bedding, perform a final trim using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells shall be made as required.
 3. The pipe zone shall be backfilled with the indicated backfill material. Exercise care to prevent damage to the pipeline coating, cathodic bonds, and the pipe itself during the installation and backfill operations.
 4. If a moveable trench shield is used during backfill operations the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer. Do not displace the pipe or backfill while the shield is being moved.
- B. Trench Zone: After the pipe zone backfills have been placed, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway base.

C. Marking Tape Installation:

1. Continuously install metallic marking tape along the pipe at a depth of 2 feet below finish grade.
- D. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway base.

3.50 FILL AND EMBANKMENT CONSTRUCTION

- A. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Unless otherwise approved by the CONSTRUCTION MANAGER, the depth of each uncompacted layer shall not exceed 8 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted to a minimum of 95 percent of maximum density under structures and paved areas, and a minimum of 90 percent of maximum density elsewhere, with moisture condition to plus or minus 2% of optimum moisture content.
- B. Embankment or structure fills over pipelines shall be placed as set forth in Subparagraph 3.9.D of this Specification Section.

3.11 FIELD TESTING

- A. General: All field soils testing will be done by a testing laboratory of the OWNER's choice at the CONTRACTOR's expense except as indicated below.
- B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557. Field density in-place tests will be performed in accordance with ASTM D 1556 or by such other means acceptable to the CONSTRUCTION MANAGER.
- C. In case the test of the fill or backfill show noncompliance with the required density, perform remedies as may be required to ensure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the CONTRACTOR and shall be at no additional cost to the OWNER.

3.12 SHORING, SHEETING AND BRACING INSTALLATION

- A. General: Provide safe working conditions, to prevent shifting of material, to prevent damage to structures or other Work, to avoid delay to the Work, all in accordance with applicable safety and health regulations. Properly shore, sheet, and brace all excavations which are not cut back to the proper slope and where shown. Meet the general trenching requirements of the applicable safety and health regulations for the minimum shoring, sheeting, and bracing for trench excavations.

- B. CONTRACTOR's Responsibility: Sole responsibility for the design, methods of installation, and adequacy of the shoring, sheeting, and bracing.
- C. Arrange shoring, sheeting, and bracing so as not to place any strain on portions of completed Work until the general construction has proceeded far enough to provide ample strength.
- D. If CONSTRUCTION MANAGER is of the opinion that at any point the shoring, sheeting, or bracing are inadequate or unsuited for the purpose, resubmission of design calculations and working drawings for that point may be ordered, taking into consideration the observed field conditions. If the new calculations show the need for additional shoring, sheeting, and bracing it should be installed immediately.
- E. Accurately locate all underground utilities and take the required measures necessary to protect them from damage. All underground utilities shall be kept in service at all times as specified in Division 1.
- F. Sheet Removal: In general, remove sheeting and bracing above the top of the pipe as excavation is refilled in a manner to avoid the caving in of the bank or disturbance to adjacent areas or structures.

- END OF SECTION -

SECTION 02576 - DUCTILE IRON PIPE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all materials, equipment and services required for a complete installation of ductile iron pipe as specified and shown on the drawings. All materials shall be new and of current manufacture.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/AWWA C111/A21.11	Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings
ANSI/AWWA C151/A21.51	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water and Other Liquids.
ANSI/AWWA C104/A21.4	Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
ANSI/AWWA C115/A21.15	Flanged Ductile Iron and Gray-Iron Pipe with Threaded Flanges
ANSI/AWWA C110/A21.10	Ductile Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch, for Water and Other Liquids
AWWA C153/A21.53	Ductile Iron Compact Fittings, 3-Inch Through 16-Inch (75mm through 300 mm), for Water and Other Liquids
ANSI/AWWA C600	Installation of Ductile Iron Water Mains and their Appurtenances
ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids

1.3 CONTRACTOR SUBMITTALS

- A. For the materials and equipment items supplied under the provisions of this Section, submit copies of the manufacturer's product specifications and performance details according to the requirements of Section 01300 - Contractor Submittals.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Rubber gaskets for the sealing of joints on ductile iron pipe shall conform to ANSI/AWWA C111/A21.11.
- B. Cement for mortar lining shall conform to ANSI/AWWA C104/A21.4 and shall be Type II or Type V. A fly ash or pozzolan shall not be used as a cement replacement.
- C. Water for cement mortar shall be potable water, clean and free from organic matter, strong alkalis, vegetable matter and other impurities.

2.2 DUCTILE IRON PIPE

- A. Unless otherwise specified or shown on the drawings, ductile iron pipe shall be Class 350 and shall conform to ANSI/AWWA C151/A21.51.
- B. Ductile iron pipe shall be cement mortar lined in accordance with ANSI/AWWA C104/A21.4, except as modified herein. The thickness of the cement mortar lining shall not be less than 1/8-inch for 4-inch through 12-inch diameter pipe; and 3/16-inch for 14-inch through 36-inch diameter pipe. All ductile iron pipe shall be provided with an eight mil polyethylene or other suitable impermeable bulkhead on the ends of the pipe and all special openings.
- C. Ductile iron pipe installed below grade shall employ either mechanical joints or restrained joints or push-on joints conforming to ANSI/AWWA C115/A21.11. Restrained joints shall be Lok-Ring or Flex-Ring by American Pipe, TR-Flex by U. S. Pipe, Super-Lock by Clow, Lock-Ring by McWane, Lock-Joint by Pacific States Cast Iron Pipe, Megalug Series 1100 by EBBA Iron, Inc., or approved equal.
- D. Ductile iron pipe installed above grade shall employ flanged joints conforming to ANSI/AWWA C115/A21.15.

2.3 FITTINGS AND COUPLINGS

- A. Unless otherwise specified or shown on the drawings, all fittings to be used with ductile iron pipe shall conform to either ANSI/AWWA C110/A21.10 or AWWA C153/A21.53. All ductile iron fittings shall be lined with cement mortar in accordance with ANSI/AWWA C104/A21.4. All fittings and joint connections shall be thoroughly cleaned, coated and wrapped in accordance with these specifications.

PART 3 -- EXECUTION

3.1 INSTALLATION OF DUCTILE IRON PIPE

- A. Ductile iron pipe shall be installed in accordance with ANSI/AWWA C600 and the manufacturer's recommendations except as otherwise provided herein.

- B. All damaged or defective ductile iron pipe and appurtenances shall be rejected and removed from the job site.
- C. Trenches shall be in a reasonably dry condition when the pipe is laid. The CONTRACTOR shall employ dewatering methods as required to maintain the trench in a reasonably dry condition. Necessary facilities shall be provided by the CONTRACTOR for lowering and properly placing the pipe sections into the trench without damage. The pipe shall be laid carefully to the lines and grades, or to the minimum depths shown on the drawings, and the sections shall be closely jointed to form a smooth flow line.
- D. Ductile iron pipe shall be polyethylene-encased in accordance with ANSI/AWWA C105/A21.5 however, two wraps shall be utilized instead of one.
- E. The following minimum covers shall be maintained unless otherwise shown on the drawings. A minimum of 48-inch of cover shall be maintained over pipe 4-inch through 18-inch diameter where there is not an established street grade. The following minimum covers shall be maintained where there is an established street grade.

Minimum cover		
Pipe size, in.	Right-of-way greater than or equal to 80 ft.	Right-of-way less than 80 ft
4 -12	4 ft	4 ft
14 -36	5 ft	5 ft

- F. The maximum allowable joint deflection for push-on type joint and mechanical-joint pipe shall be as follows:

PUSH-ON TYPE JOINTS					
		Maximum offset, in.		Radius of curve	
Pipe size, in.	Joint Deflection , deg	18-ft length	20-ft length	18-ft length	20-ft length
4-12	2.5	9	10	415	460
14-36	1.5	6	6	690	765

MECHANICAL JOINT PIPE					
4	4.0	15	17	260	290
6	3.5	13	15	295	330
8-12	2.5	9	10	415	460
14-36	1.5	6	6	690	765

3.2 POLYETHYLENE ENCASEMENT

- A. The polyethylene encasement shall conform to the requirements of ANSI/AWWA C105/A21.5. The polyethylene film shall have a minimum thickness of eight mils. The minus tolerance on thickness shall not exceed 10 percent of the nominal thickness. The encasement of piping with polyethylene shall be in either tube or sheet form. The tube size or sheet width for each pipe diameter shall be as follows:

Nominal pipe diameter, in.	Minimum width, in.	
	Flat tube	Polyethylene Sheet
4	16	32
6	20	40
8	24	48
10	27	54
12	30	60
14	34	68
16	37	74
18	41	82
20	45	90
24	54	108

- B. Polyethylene film shall be manufactured from a Type I, Class C (black) raw polyethylene material.
- C. At the direction of the Engineer the CONTRACTOR shall repair any damage to the polyethylene film as described within ANSI/AWWA C105/A21.5 or shall replace all damaged sections of the polyethylene film.

3.3 PIPELINE MARKING TAPE

- A. Provide pipeline marking tape in accordance with the requirements of Section 02200 EARTHWORK.

- END OF SECTION -

SECTION 02577 – POLYVINYL CHLORIDE PRESSURE PIPE

PART 1—GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all labor, equipment, materials and services required for a complete installation of polyvinyl chloride pressure pipe as shown on the drawings. All materials shall be new and of current manufacture.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ASTM D 1785	Poly (vinyl chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120
ASTM D 2466	Poly (vinyl chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	Poly (vinyl chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	Solvent Cements for Poly (vinyl chloride) (PVC) Plastic Piping System
ASTM D 2855	Practice for Making Solvent-Cemented Joints with Poly (vinyl chloride) (PVC) Pipe and Fittings
ASTM F 477	Elastomeric Seals (gaskets) for Joining Plastic Pipe

1.3 CONTRACTOR SUBMITTALS

- A. For the materials and equipment items supplied under the provisions of the Section, submit copies of the manufacturer's product specifications and performance details according to the requirements of Section 01300 – Contractor Submittals.

PART 2—PRODUCTS

2.1 PIPE

- A. Unless otherwise specified or shown on the drawings, polyvinyl chloride pressure pipe shall be Schedule 40 or 80 and shall conform to ASTM D 1785. Polyvinyl chloride pressure pipe shall have been manufactured within the 18-month period prior to installation. Polyvinyl chloride pressure pipe shall be date-coded by the manufacturer with the AUTHORITY being provided the manufacturer's code for translation. Rubber rings shall conform to the "Standard Specification for Elastometric Seals (Gaskets) for Joining Plastic Pipe" (ASTM F477).

- B. Cemented joints shall be in accordance with ASTM D 2855. Solvent-cement shall conform to the requirements of ASTM D 2564 and shall have a minimum chemical resistance to 12 percent solution of sodium hypochlorite.
- C. All material shall be NSF approved for use with potable water.

2.2 FITTINGS

- A. Unless otherwise specified or shown on the drawings, all fittings to be used with polyvinyl chloride pressure pipe shall conform to either ASTM D 2466 or ASTM D 2467. All fittings and joint connections shall be thoroughly cleaned, coated and wrapped in accordance with these specifications.
- B. The CONTRACTOR may use a flange adapter designed for AWWA C900 when connecting polyvinyl chloride pressure pipe to flanged fittings or flanged valves, Uni-Flange Series 900, EBAA Iron Series 3500, or an approved equal. Pipe ends must be cut smooth and square with no bevel. All flange adapters shall be thoroughly cleaned and coated or wrapped in accordance with these specifications.
- C. Polyvinyl chloride pressure pipe restraining devices shall be Uni-Flange 4 inches through 12 inches 1300 Restrainers and 4 inches through 12 inches 1350 Restrainers manufactured by Uni-Flange, Megalug 4 inches through 12 inches Series 2000 PV Retainer Gland manufactured by EBAA Iron, or approved equal.

PART 3—EXECUTION

3.1 GENERAL

- A. Polyvinyl chloride pressure pipe shall be installed in accordance with the AWWA Manual M23, and the manufacturer's recommendations except as otherwise provided herein or shown on the drawings.
- B. Polyvinyl chloride pressure pipe shall be connected to 4-inch, 6-inch, and 8-inch diameter pipe by use of the proper transition gaskets manufactured by Newby, Meridian Ventures, Inc., or an approved equal.
- C. Polyvinyl chloride pressure pipe shall be connected to 10-inch and 12-inch pipe by use of the proper transition couplings manufactured by Romac Industries, Rockwell International, or an approved equal.
- D. The manufacturer's recommended pipe lubricant shall be used when making pipe connections by lubricating the spigot end up to and including the reference mark. The reference mark on the spigot end must be flush with the end of the bell. AWWA Manual M23 and the manufacturer's recommendations shall be followed.
- E. Polyvinyl chloride pressure pipe shall be stored at the job site in a unit package provided by the manufacturer. Pipe and gaskets shall not be stored close to a source of heat and must be kept free of dirt, foreign matter, oil and grease. Gaskets shall not be exposed to sunlight.

- F. Necessary precautions shall be employed to prevent the pipe from floating due to water entering the trench from any source. Trenches shall be in a reasonably dry condition when the pipe is laid. The inside of the pipe shall be maintained free from foreign materials and in a clean and sanitary condition until its acceptance by the District. All exposed piping shall be adequately supported with devices approved by the CONSTRUCTION MANAGER.
- G. Heavily padded straps or harnesses for handling polyvinyl chloride pressure pipe shall be provided for the lowering and proper placement of pipe sections into the trench. The pipe shall be laid carefully to the lines and grades shown, or to the minimum depths shown on the drawings, and the sections shall be closely jointed to form a smooth flow line. Exceptional care shall be taken in placing the pipe and making the field joints. Concrete thrust blocks shall be provided at the locations and of the sizes shown on the drawings.
- H. Polyvinyl chloride pressure pipe, couplings, and rubber rings shall be free from damage and defects in material and workmanship. All damaged or defective materials shall be rejected and removed from the job site.
- I. Polyvinyl chloride pressure pipe showing signs of physical damage or unacceptable ultraviolet exposure as determined through visual inspection by the CONSTRUCTION MANAGER may be rejected. Material so rejected shall be approved for installation, if, at the sole cost and expense of others, the CONSTRUCTION MANAGER is provided documented test results prepared by a certified testing laboratory showing the rejected pipe to be in conformance with AWWA C900, provided the sun fading or discoloration that caused the rejection is placed in the trench downward.
- J. Unless otherwise shown on the drawings, a minimum of 48 inches of cover shall be maintained where there is not an established street grade. Where there is an established street grade, and the street is 80 feet wide or more, 42 inches of cover shall be maintained. For streets less than 80 feet wide, 36 inches of cover shall be maintained.
- K. Polyvinyl chloride pressure pipe shall be deflected uniformly throughout each pipe length. Deflection shall be accomplished by staking the pipe on both sides of the joint so that deflection at the joint is minimized. The maximum allowable pipe deflection for factory belled pipe shall be as follows:

Pipe Size, Inches	Maximum Offset, inches	Minimum radius of curvature for 20-ft lengths, ft.
4	24	100
6	17	144
8	12	189
10	11	123
12	9	275

3.2 PIPE LOCATOR RIBBON

- A. Pipe locator ribbon shall be installed over all polyvinyl chloride pressure pipe in accordance with local agency requirements. Pipe locator ribbon shall be 3 inches wide plastic coated aluminum and shall be clearly marked "CAUTION BURIED WATER LINE" continuously along the length of the ribbon with minimum 1-1/4 inch letters. The ribbon shall be blue in color and shall be "alarmatape" pipe locator ribbon as manufactured by Paul Potter Associates, "Terra Tape" as manufactured by Griffolyn Company, Inc., "Detectatape" as manufactured by Allen Systems, Inc., or approved equal.

-END OF SECTION-

SECTION 02578 – POLYVINYL CHLORIDE SEWER and DRAIN PIPE

PART 1—GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all labor, equipment, materials and services required for a complete installation of polyvinyl chloride drain pipe as shown on the drawings. All materials shall be new and of current manufacture.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Commercial Standards

ASTM D2321	Standard Practice for Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
ASTM D3034	Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
ASTM D3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
ASTM F477	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 CONTRACTOR SUBMITTALS

- A. For the materials and equipment items supplied under the provisions of the Section, submit copies of the manufacturer's product specifications and performance details according to the requirements of Section 01300 – Contractor Submittals.

PART 2—PRODUCTS

2.1 PIPE

- A. Unless otherwise specified or shown on the drawings, polyvinyl chloride drain pipe shall be SDR 23.5 and shall conform to ASTM D3034 Polyvinyl Chloride sewer pipe shall have been manufactured within the 18-month period prior to installation. Polyvinyl chloride sewer pipe shall be date-coded by the manufacturer with the OWNER being provided the manufacturer's code for translation. Rubber rings shall conform to the "Standard Specification for Elastometric Seals (Gaskets) for Joining Plastic Pipe" (ASTM F477).

2.2 FITTINGS

- A. Unless otherwise specified or shown on the drawings, all fittings to be used with polyvinyl chloride pressure pipe shall conform to ASTM D3034.

PART 3—EXECUTION

3.1 GENERAL

- A. Polyvinyl chloride drain pipe shall be installed in accordance with the ASTM D2321, and the manufacturer's recommendations except as otherwise provided herein or shown on the drawings.
- B. The manufacturer's recommended pipe lubricant shall be used when making pipe connections by lubricating the spigot end up to and including the reference mark. The reference mark on the spigot end must be flush with the end of the bell. ASTM D2321 and the manufacturer's recommendations shall be followed.
- C. Polyvinyl chloride drain pipe shall be stored at the job site in a unit package provided by the manufacturer. Pipe and gaskets shall not be stored close to a source of heat and must be kept free of dirt, foreign matter, oil and grease. Gaskets shall not be exposed to sunlight.
- D. Necessary precautions shall be employed to prevent the pipe from floating due to water entering the trench from any source. Trenches shall be in a reasonably dry condition when the pipe is laid. The inside of the pipe shall be maintained free from foreign materials and in a clean and sanitary condition until its acceptance by the OWNER. All exposed piping shall be adequately supported with devices approved by the CONSTRUCTION MANAGER.
- E. Heavily padded straps or harnesses for handling polyvinyl chloride drain pipe shall be provided for the lowering and proper placement of pipe sections into the trench. The pipe shall be laid carefully to the lines and grades shown, or to the minimum depths shown on the drawings, and the sections shall be closely jointed to form a smooth flow line. Exceptional care shall be taken in placing the pipe and making the field joints.
- F. Polyvinyl chloride drain pipe, couplings, and rubber rings shall be free from damage and defects in material and workmanship. All damaged or defective materials shall be rejected and removed from the job site.
- G. Polyvinyl chloride drain pipe showing signs of physical damage or unacceptable ultraviolet exposure as determined through visual inspection by the CONSTRUCTION MANAGER may be rejected.
- H. Polyvinyl chloride drain pipe shall be installed as indicated on the drawings.
- I. Perforated pipe shall be installed with the perforations down.

-END OF SECTION-

SECTION 02643 - WATER PIPELINE TESTING AND DISINFECTION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform cleaning and testing of all pipelines and appurtenant piping for potable water, complete, all in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:

ANSI/AWWA B300	Hypochlorites
ANSI/AWWA B301	Liquid Chlorine
ANSI/AWWA C651	Disinfecting Water Mains

1.3 CONTRACTOR SUBMITTALS

- A. A testing schedule, including proposed plans for water conveyance, control, disposal, health and safety plan, communications plan and contingency plans shall be submitted in writing for approval a minimum of 21 days prior to proposed testing start.
- B. CONTRACTOR shall prepare and submit a log of all samples collected for bacteriological tests indicating facility, station number, free chlorine residual and pH. CONTRACTOR to provide a log of all appurtenances flushed with highly chlorinated water.

1.4 QUALITY ASSURANCE

- A. Schedule disinfection operation as late as possible during contract time period to assure maximum degree of sterility of facilities when the Work is accepted by the OWNER.

PART 2 -- PRODUCTS

2.1 MATERIALS REQUIREMENTS

- A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, backflow prevention devices, pumps or other water control equipment and materials shall be determined and furnished by the CONTRACTOR subject to the CONSTRUCTION MANAGER's review. No materials shall be used which would be injurious to the construction or its future function.

Gauges used in the test shall be accompanied with satisfactory certifications of accuracy from a laboratory approved by the CONSTRUCTION MANAGER.

- B. Chlorine shall be in the form of liquid chlorine, sodium hypochlorite solution, or calcium hypochlorite granules or tablets.
- C. Liquid chlorine shall be in accordance with the requirements of ANSI/AWWA B301. Liquid chlorine shall be used only:
 1. In combination with appropriate gas flow chlorinators and ejectors;
 2. Under the direct supervision of an experienced technician;
 3. When appropriate safety practices are observed.
- D. Sodium hypochlorite and calcium hypochlorite shall be in accordance with the requirements of ANSI/AWWA B300 - Hypochlorite.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Unless otherwise indicated herein, water for testing and disinfecting water pipelines will be furnished by the OWNER. The OWNER will bear the costs of the water for the initial hydrotest. If the pipeline does not meet the criteria and requires additional testing, the CONTRACTOR shall bear costs of the water for testing and disinfecting after the first hydrotest. The CONTRACTOR shall make all necessary provisions for obtaining and conveying the water from the source to the points of use, and disposal of the water (including dechlorinating - where applicable).
- B. All pressure pipelines shall be tested. Disinfection shall be accomplished by chlorination. All chlorinating and testing operations shall be performed in the presence of the CONSTRUCTION MANAGER.
- C. Disinfection operations shall be scheduled as late as possible during the contract time period so as to assure the maximum degree of sterility of the facilities at the time the Work is accepted by the OWNER. Samples for bacteriological testing shall be completed by the CONTRACTOR, and testing shall be preformed by a certified laboratory and at the expense of the CONTRACTOR. Results of the bacteriological testing shall be satisfactory with the AZ DEQ and Mohave County Health Dept.
- D. Pipeline pressure tests will include the following tests:
 1. Hydrostatic pressure test.
 3. The CONTRACTOR shall conduct the discharges in accordance with the CONTRACTOR's Temporary Discharge Permit from the AZ DEQ. If the discharge can potentially reach a wash or storm drain that would drain to the Colorado River, the CONTRACTOR shall dechlorinate to a chlorine residual acceptable by the Temporary Discharge Permit. The CONTRACTOR shall conduct the water quality sampling required under the Temporary Discharge Permit. The CONTRACTOR shall notify local agencies, secure appropriate permits and approvals, and provide erosion control measures as appropriate.

3.2 HYDROSTATIC TESTING OF PIPELINES

- A. Prior to hydrostatic testing, all pipelines shall be flushed, swept, or blown out as appropriate. Test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. The CONTRACTOR shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to or movement of the adjacent pipe. Any unharvested sleeve-type couplings, expansion joints, or other sliding joints shall be restrained or suitably anchored prior to the test, to avoid movement and damage to piping and equipment. Provide sufficient temporary air tappings in the pipelines to allow for evacuation of all entrapped air in each pipe segment to be tested. After completion of the tests, such taps shall be permanently plugged. Care shall be taken to see that all air vents are open during filling.
- B. The hydrostatic test water shall contain 50 mg/l free chlorine. Potable water shall be used for hydrostatic testing of the pipe. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the CONSTRUCTION MANAGER shall be taken.
- C. The hydrostatic test shall consist of holding the test pressure of 150 psi on the pipeline for a period two hours. All visible leaks shall be repaired in a manner acceptable to the CONSTRUCTION MANAGER. The allowable leakage for 12" pipe shall be 2.3 gallons per 1000 L.F. of pipe. Pipe with welded joints shall have no leakage.

3.3 DISINFECTING PIPELINES

- A. General: All potable water pipelines except those appurtenant to hydraulic structures shall be disinfected in accordance with the requirements of ANSI/AWWA C651 - Disinfecting Water Mains as modified herein.
- B. Continuous Feed Method: Disinfect in accordance with ANSI/AWWA C651 except that:
 1. The water in the pipe shall contain 50 mg/l free chlorine.
 2. After 24 hours of disinfection, the residual free chlorine shall be at least 25 mg/l at the pipeline extremities.
- C. Slug Feed Method: Disinfect in accordance with ANSI/AWWA C651.

- D. Chlorinating Valves: During the process of chlorinating the pipelines, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily chlorinated water.
- E. Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the pipeline until chlorine measurements show that the concentration in the water leaving the pipeline is no higher than that generally prevailing in the system or is acceptable for domestic use. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize thoroughly the chlorine residual remaining in the water.
- F. Sampling Ports: The CONTRACTOR shall provide sampling ports along the pipeline as defined in AWWA C651. Taps may be made at manways and air valves to help facilitate the spacing requirement.
- G. Bacteriological Testing: After final flushing and before the pipeline is placed in service, a sample, or samples shall be collected by the CONTRACTOR from the end of the line, and shall be tested by the CONTRACTOR for testing bacteriological quality in accordance with the requirements of the AZ DEQ and Mohave County Health Dept. For this purpose the pipe shall be refilled with fresh potable water and left for a period of 24 hours before any sample is collected. Should the initial disinfection treatment fail to produce satisfactory bacteriological test results, the disinfection procedure shall be repeated at no additional cost to the OWNER until acceptable results are obtained.

- END OF SECTION -

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SECTION 02830 - CHAIN LINK FENCING AND GATES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide chain link fencing and gates and all appurtenant Work, complete and operable, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated, Welded and Seamless.
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 392	Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 150	Specification for Portland Cement.
ASTM F 668	Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Chain link fencing and gates, including necessary erection accessories, fittings, and fastenings, shall be products of a single manufacturer who has been successfully engaged in the production of the items specified herein for at least 5 years.
- B. Installer's Qualifications: The installer shall be employed by or licensed by the manufacturer and recognized and accepted by the manufacturer as qualified to install the chain link fencing, gates and accessory items specified herein.
- C. Regulatory Requirements: Chain link fencing, gates and accessories shall be furnished and installed in conformance with all applicable local codes and ordinances, as well as all safety and health practices.

1.4 CONTRACTOR SUBMITTALS

- A. General: Provide the following submittals in accordance with the requirements in Section 01300 - Contractor Submittals.
- B. Product Data: Submit manufacturer's catalog and technical data, product specifications, standard details, certified product test results, installation instructions and general recommendations, for specified metal fencing, fabric, gates and accessories.
- C. Shop Drawings: Submit a scale layout of fencing, gates, and accessories. Drawings shall define fence height, post layout, including sizes and sections; post setting and bracing configuration, details of gates, corner construction, barbed wire support arms and other accessories as may be necessary to completely describe the specified configuration.
- D. Samples: Submit samples, minimum 12 inches long, of actual fence components, to illustrate color and finish.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Dimensions indicated herein for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Fence fabric height shall be 6 feet unless otherwise indicated. Fencing shall be topped with three lines of barbed wire on single, 45-degree supporting arms, unless otherwise indicated.
- C. All fencing materials shall be hot-dip galvanized after fabrication. All materials and components shall be new, specifically manufactured for the intended application.
- D. The height of the fence and clearance around electrical equipment areas, gas yards or other hazardous areas shall be in accordance with applicable local and national codes and practices as well as all safety and health practices.

2.2 STEEL FABRIC

- A. Fabric: Fence fabric shall be No. 9 gauge galvanized steel wire, 2-inch mesh. The fabric shall have top selvages knuckled and bottom selvages twisted and barbed. Two types of fabric finish are described below. Heavy, industrial-grade galvanized and PVC coated.
- B. Fabric Finish: Fabric shall be galvanized in conformance with ASTM A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric, Class II, with not less than 2.0 ounces zinc per square feet of coated surface.

- C. Fabric Finish: Fabric shall be galvanized in conformance with ASTM A 392, Class I, with not less than 1.2 ounces zinc per square feet of coated surface, and then thermally bonded with a 7-mil polyvinyl chloride (PVC) plastic resin coating.
1. PVC coating shall comply with ASTM F 668-Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric, Class 2, except core wire shall measure 9 gauge prior to application of non-metallic coating.
 2. Vinyl coating shall be made from a virgin polyvinyl chloride resin with plasticizer, stabilizers and ultraviolet inhibitor. Coating shall have a tensile strength of 2,500 psi or more, with a minimum elongation of 200 percent, and a Shore Durometer hardness of 40 to 46.
 3. PVC coating color shall be as selected by the CONSTRUCTION MANAGER from manufacturer's standard colors.

2.3 FRAMING AND ACCESSORIES

- A. Steel Framework, General: Framework components shall be fabricated of galvanized steel conforming to ASTM A 53 or ASTM A 123, with not less than 1.8 ounces zinc per square feet of coated surface.
1. Fittings and accessories shall be galvanized in accordance with ASTM A 153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, with zinc weights per Table I of that specification.
 2. Steel Framework Finish: Framework, fittings and accessories shall be shall be galvanized per ASTM A 153 with zinc weights per Table I of that specification, and then finished with manufacturer's standard thermally bonded polyvinyl chloride (PVC) plastic resin finish, not less than 10 mils thick.
 3. Vinyl coating shall be made from a virgin polyvinyl chloride resin with plasticizer, stabilizers and ultraviolet inhibitor. Coating shall have a tensile strength of 2500 psi or more, minimum elongation of 200 percent, and a Shore Durometer hardness of 40 to 46.
 4. PVC coating color shall be as selected by the CONSTRUCTION MANAGER from manufacturer's standard colors.
- B. End, Corner and Pull Posts: All posts shall be one-piece without circumferential welds. Minimum sizes and weights shall conform to the following:
1. 2.875-inch OD steel pipe, 5.79 pounds per linear feet, or 3.5-inch by 3.5-inch, roll-formed sections, 4.85 pounds per linear feet.
- C. Line Posts: Line posts shall be spaced no more than 10 feet on center, and shall conform to the following minimum sizes and weights:
1. 2.375-inch OD steel pipe, 3.65 pounds per linear feet, or 2.25-inch by 1.875-inch H-sections, 2.64 pounds per linear feet.

D. Gate Posts: Gate posts shall be provided in conformance with the following minimum sizes and weights, for support of a single gate leaf, or each leaf of a double gate pair:

<u>Leaf Width:</u>	<u>Gate Post Size:</u>	<u>Gate Post Weight:</u>
Less than 6 feet	3.5-inch by 3.5-inch roll-formed section or 2.875-inch OD pipe	4.85 lbs./lin. ft. 5.79 lbs./lin. ft.
	4.0-inch OD pipe	9.11 lbs./lin. ft.
Over 13 feet to 18 feet	6.625-inch OD pipe	28.55 lbs./lin. ft.

E. Top Rail: Top railing shall be provided in Manufacturer's longest lengths, with expansion type couplings, approximately 6 inches long, for each joint. Fence design shall provide for positive, secure attachment of top rail to each gate post, corner post, pull post and end post.

1. Top rail shall consist of 1.66-inch OD pipe, 2.27 pounds per linear feet or roll-formed sections, 1.625-inch by 1.25-inch, 1.35 pounds per linear feet.

F. Tension Wire: Tension wire shall be located at the bottom of the fabric and shall consist of No. 7 gauge, coated coil spring wire of metal and finish to match fabric. Zinc coating shall weigh not less than 1.6 ounces per square foot. Tension wire shall be interlaced with the fabric or attached to the fabric along the extreme bottom of the fence. Tension wire attachment shall be with fabric tie wires, at a spacing of no more than 24 inches apart.

G. Fabric Tie Wires: Fabric tie wires shall be No. 9 gauge galvanized steel wire of the same finish as the fabric. Aluminum ties shall not be used. Ties shall be spaced 14 inches apart on posts and 24 inches apart on rails.

H. Post Brace Assembly: Post brace assembly shall be manufacturer's standard adjustable brace assembly provided at each end post, gate post and at both sides of each corner post and intermediate brace post. Material used for brace shall be same as top rail. Truss bracing between line posts shall be achieved with 0.375-inch diameter rod and adjustable tensioner.

- I. Post Tops: Post top shall be a weather-tight closure cap, purpose-designed for containment of top rail and positive, permanent attachment to post. One cap shall be provided for each post.
- J. Stretcher Bars: Stretcher bars shall be one-piece lengths equal to the full height of the fabric, with minimum cross-section of 3/16 inch by 3/4 inch. One stretcher bar shall be provided for each gate and end post, and two for each corner and intermediate brace post.

- K. Stretcher Bar Bands: Stretcher bar bands shall be one-piece fabrications designed to secure stretcher bars to end, corner, intermediate brace, and gate posts. Bands shall have a minimum cross-section of 1/8 inch by 3/4 inch. Stretcher bar bands shall be spaced no more than 15 inches on center.
- L. Barbed Wire Supporting Arms: Supporting arms shall be Manufacturer's standard fabrication, of metal and finish to match fence framework, with provision for anchorage to each post and attachment of three rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap. Supporting arm shall be single 45-degree arm type and shall be capable of withstanding 250 pounds of downward pull at outermost end.
- M. Barbed Wire: Barbed wire shall be two-strand, No. 12-1/2-gauge zinc-coated steel or iron wire with four-point, 14-gauge barbs spaced no more than 5 inches apart.

2.4 GATES

- A. Fabrication: Perimeter frames of gates shall be fabricated from same metal and finish as fence framework. Gate frames shall be assembled by welding or with purpose-designed fittings and rivets for rigid, secure connections. All welds shall be ground smooth. Gate frames and any ungalvanized hardware, shall be hot-dip galvanized after fabrication. Horizontal and vertical members shall be provided to ensure proper gate operation and attachment of fabric, hardware and accessories.
 - 1. Fabric for gates shall match fence fabric, unless otherwise indicated. Fabric shall be installed with stretcher bars at all perimeter edges. Stretcher bars shall be attached to gate frame with stretcher bar bands spaced no more than 15 inches on center.
 - 2. Each gate shall be diagonally cross-braced with a 3/8-inch diameter adjustable length truss rod to ensure frame rigidity without sag or twist.
 - 3. Where barbed wire is indicated above gates, vertical members shall be extended and fabricated as required to receive barbed wire supporting arms.
- B. Swing Gates: Perimeter frames of swing gates shall be constructed of 1.9-inch OD steel pipe, 2.7 pounds per linear feet.
 - 1. Tamper-proof hardware and accessories shall be provided for each gate, galvanized in conformance with ASTM A 153, and in accordance with the following:
 - a. Hinges: Hinges shall be of size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Three hinges shall be provided for each leaf 6 feet or more in height.
 - b. Latch: Latch shall be forked type or plunger-bar type, permitting operation from either side of the gate, with padlock eye as an integral part of the latch.

- c. Keeper: Keeper shall be provided for vehicle gates, which automatically engages the gate leaf and holds it in the open position until it is manually released.
- d. Double Gates: Gate stops shall be provided for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Locking device and padlock eyes shall be provided as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.

2.5 RELATED ITEMS

- A. Concrete: Concrete for posts shall be 3000 psi, sitework concrete in accordance with Section 03300-Cast-In-Place Concrete.
- B. Nuts, bolts and screws shall be steel, minimum size 3/8-inch diameter, hot-dip galvanized after fabrication.
- C. PVC slats shall be a PVC material similar to the PVC fabric coating or high density virgin polyethylene slats with an ultraviolet inhibitor. The slats shall be a tubular shape with a nominal wall thickness of 0.030 inch and installed with a retaining channel top and bottom. The color shall be as indicated or as selected by the CONSTRUCTION MANAGER.

2.6 MANUFACTURERS, OR EQUAL

- A. American Fence Corp.
- B. Anchor Fence, Inc.
- C. United States Steel.

PART 3 -- EXECUTION

3.1 INSPECTION

- A. Prior to commencing installation, CONTRACTOR shall require installer to inspect all areas and conditions within which Work of this Section will be performed. All critical dimensions and clearances shall be verified. Final grading shall be completed and all earth, brush, or other obstructions which interfere with the proper alignment and construction of fencing shall be removed.
- B. Commencement of installation shall indicate evidence of installer's acceptance of conditions and substrates as suitable for successful completion of chain link fencing installation.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, all posts shall be set in concrete. Gate posts, corner posts, and other critical elements shall be provided with concrete foundations which are designed by an engineer to safely accommodate the loads to which they will be subjected.
- B. Excavation: Holes for posts shall be drilled or hand excavated to the diameters and spacings indicated, in firm, undisturbed or compacted soil.
 1. Unless otherwise indicated on the Drawings, holes for posts shall be excavated to a diameter not less than 12 inches or not less than five times the largest dimension of the item being anchored, whichever is larger.
 2. Unless otherwise indicated, depth for holes shall be not less than 40 inches; excavated approximately 4 inches lower than the post bottom, with bottom of posts set not less than 36 inches below finish grade surface.
- C. Setting Posts: Line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts, parallel to the ground slope. Posts shall be set plumb and shall be centered in holes, 4 inches above the bottom of the excavation, with posts extending not less than 36 inches below finish grade surface.
 1. Corner posts shall be installed where changes in the fence lines equal or exceed 15 degrees, measured horizontally.
 2. Each post shall be properly aligned vertically and its top aligned parallel to the ground slope. Posts shall be maintained in proper position during placement and finishing operations.
- D. Concrete
 1. Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing concrete, the earth around the hole shall be thoroughly moistened.
 2. Encasement concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating.
 3. Concrete footings shall have a neat appearance and shall be extended 2 inches above grade and troweled to a crown to shed water.
 4. A minimum of 7 days shall elapse after placing the concrete footings before the fence fabric or barbed wire is fastened to the posts.
- E. Bracing: Bracing shall be provided at all ends, corners, gates, and intermediate brace posts. Corner posts and intermediate brace posts shall be braced in both directions. Horizontal brace rails shall be set midway between the top rail and the ground, running

from the corner, end, intermediate brace or gate post to the first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

1. Braces shall be so installed that posts remain plumb when diagonal rod is under proper tension.
- F. Intermediate Brace Posts: Where straight runs of fencing exceed 500 feet, intermediate brace posts shall be installed, spaced equally between ends or corners; with additional posts provided as required, such that the spacing between intermediate brace posts does not exceed 500 feet. Intermediate brace posts shall be equivalent in size to corner posts and shall be braced with horizontal brace rails and diagonal tension members in both directions.
- G. Top Rails: Top rails shall be run continuously through post caps, bending to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.
- H. Center Rails: Center rails shall be provided where indicated. Rails shall be installed in one piece, between posts and flush with posts on fabric side, using special offset fittings where necessary.
- I. Tension Wire: Continuous bottom tension wire shall be stretched tight with turnbuckles at end, gate, intermediate and corner posts. Tension wire shall be installed on a straight grade between posts, with approximately 2 inches of space between finish grade and bottom selvage, unless otherwise indicated. Tension wire shall be tied to each post with not less than 6-gauge galvanized wire.
- J. Fabric
 1. Chain-link fabric shall be fastened on the secured side of the posts.
 2. Fabric shall be stretched and securely fastened to posts. Between posts, top and bottom edges of the fabric shall be fastened to the top rail and bottom tension wire, respectively.
 3. Fabric shall be stretched and anchored in such a manner that it remains in tension after the pulling force is released.
- K. Tie Wires: Tie wire shall be bent to conform to the diameter of the pipe to which it is attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Ends of wire shall be bent back to minimize hazard to persons or clothing.
 1. Fabric shall be tied to line posts with tie wires spaced at 12 inches on center.
 2. Fabric shall be tied to rails and braces with tie wires spaced at 24 inches on center.
 3. Fabric shall be tied to tension wires, with hog rings spaced 24 inches on center.
- L. Stretcher Bars: Fabric shall be fastened to end, corner, intermediate brace, and gate posts with stretcher bars. Bars shall be threaded through or clamped to fabric at 4-

inches on center and secured to posts with stretcher bar bands spaced no more than 14 inches on center.

- M. Fasteners: Nuts for tension bands and hardware bolts shall be installed on the side of fence opposite the fabric side. Ends of bolts shall be peened or the threads scored to prevent removal of nuts.
- N. All galvanized coating damaged during construction of the fencing shall be repaired by application of molten Galvo-Weld; Galvinox; or equal.
- O. All damage to PVC coating shall be repaired with material equivalent in color and thickness to the original coating.

3.3 GROUNDING

- A. Fences to be grounded as indicated on the electrical grounding drawings.

- END OF SECTION -

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SECTION 09800 - PROTECTIVE COATING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide protective coatings, complete and in place, in accordance with the Contract Documents.
- B. Definitions
 - 1. The term "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.
 - 2. The term "DFT" means minimum dry film thickness.
- C. The following surfaces shall not be protective coated hereunder unless indicated.
 - 1. Concrete.
 - 2. Stainless steel.
 - 3. Machined surfaces.
 - 4. Grease fittings.
 - 5. Glass.
 - 6. Equipment nameplates.
 - 7. Platform gratings, stair treads, door thresholds, and other walk surfaces.
- D. The coating system schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the Drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Federal Specifications

DOD-P-23236 (military specifications)

Paint Coating System, Class 2 or SSPC
Paint 16 (coal tar epoxy – polyamide black
or dark red)

B. Commercial Standards

ANSI/AWWA C 105

Polyethylene Encasement

ANSI/AWWA C 209

Tape Coating Materials

1.3 CONTRACTOR SUBMITTALS

- A. General: Submittals shall be furnished in accordance with Section 01300 - Contractor Submittals, unless indicated otherwise below.
- B. Submittals shall include the following information and be submitted at least 30 days prior to protective coating work:
 1. Coating Materials List: Eight copies of a coating materials list showing the Manufacturer and the coating number, keyed to the coating systems herein. The list shall be submitted prior to or at the time of submittal of samples.
 2. Paint Manufacturer's Information: For each coating system to be used, the following data:
 - a. Paint Manufacturer's data sheet for each product proposed, including statements on the suitability of the material for the intended use.
 - b. Technical and performance information that demonstrates compliance with the system performance and material requirements.
 - c. Paint Manufacturer's instructions and recommendations on surface preparation and application.
 - d. Colors available for each product (where applicable).
 - e. Compatibility of shop and field applied coatings (where applicable).
 - f. Material Safety Data Sheet for each product used.

C. Samples

- 1. Samples of all paint, finishes, and other coating materials shall be submitted on 8-1/2-inch by 11-inch sheet metal. Each sheet shall be completely coated over its entire surface with one protective coating material, type, and color.
- 2. Two sets of color samples to match each color selected by the CONSTRUCTION MANAGER from the Manufacturer's standard color sheets. If custom mixed colors are indicated, the color samples shall be made using color formulations prepared to match the color samples furnished by the CONSTRUCTION MANAGER. The color formula shall be shown on the back of each color sample.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Suitability: Use suitable coating materials as recommended by the Manufacturer.

- B. Compatibility: In any coating system only compatible materials from a single Manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.
- C. Containers: Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all of which shall be plainly legible at the time of use.
- D. Colors: All colors and shades of colors of all coats of paint shall be as indicated or selected by the CONSTRUCTION MANAGER. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the manufacturer's standard color samples by the CONSTRUCTION MANAGER.
- E. Substitute or "Or-Equal" Products
 - 1. To establish equality, furnish satisfactory documentation from the manufacturer of the proposed substitute or equal product that the material meets the indicated requirements and is equivalent or better in the following properties:
 - a. Quality.
 - b. Durability.
 - c. Resistance to abrasion and physical damage.
 - d. Life expectancy.
 - e. Ability to recoat in future.
 - f. Solids content by volume.
 - g. Dry film thickness per coat.
 - h. Compatibility with other coatings.
 - i. Suitability for the intended service.
 - j. Resistance to chemical attack.
 - k. Temperature limitations in service and during application.
 - l. Type and quality of recommended undercoats and topcoats.
 - m. Ease of application.
 - n. Ease of repairing damaged areas.
 - o. Stability of colors.

2. Protective Coating Materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, provide the CONSTRUCTION MANAGER with the names of not less than 10 successful applications of the proposed manufacturer's products which comply with these requirements.
3. The cost of all testing and analyzing proposed substitute products which may be required by the CONSTRUCTION MANAGER shall be paid by the CONTRACTOR at no additional cost to the OWNER. If a proposed substitution requires changes in the Work, bear all such costs involved and the costs of allied trades affected by the substitution at no additional cost to the OWNER.

2.2 INDUSTRIAL COATING SYSTEMS

- A. Material Sources: Each of the following manufacturers is capable of supplying many of the industrial coating materials indicated herein. Where manufacturers and paint numbers are listed, it is to show the type and quality of coatings that are required. Proposed substitute materials will be considered as indicated above. All industrial coating materials shall be materials that have a record of satisfactory performance in industrial plants, manufacturing facilities, and water and wastewater treatment plants.
 1. Ameron.
 2. CarboLine Coatings Company.
 3. ICI Devoe Coatings Company.
 4. Glidden Coatings and Resins.
 5. International Protective Coatings - Porter.
 6. Tnemec Company.
 7. Jotun Paints, Inc..
- B. Exposed Ductile Iron or Steel Pipe - Alkyd Enamel: High quality, gloss or semi-gloss, medium long oil alkyd finish shall have a minimum solids content of 49 percent by volume. Primer shall be as recommended by manufacturer.
 1. Prime coat DFT = 3 mils Ameron 5105, Tnemec 4-55, or equal.
 2. Finish coats (2 or more, DFT = 3 mils), Ameron 5401 HS, Tnemec 2H, or equal.
 3. Total system DFT = 6 mils.

PART 3 -- EXECUTION

3.1 MANUFACTURER'S SERVICES

- A. Require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable or associated with the manufacturer's products.
- B. For submerged and severe service coating systems, require the paint manufacturer to furnish the following services:
 1. The manufacturer's representative shall furnish at least 6 hours of onsite instruction in the proper surface preparation, use, mixing, application, and curing of the coating systems.
 2. The manufacturer's representative shall observe the start of surface preparation, mixing, and application of the coating materials for each coating system.

3.2 WORKMANSHIP

- A. Skilled craftsmen and experienced supervision shall be used on all Work.
- B. Coating shall be done in a workmanlike manner so as to produce an even film of uniform thickness. Edges, corners, crevices, and joints shall receive special attention to insure thorough cleaning and an adequate thickness of coating material. The finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. The hiding shall be so complete that the addition of another coat would not increase the hiding. Special attention shall be given to insure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas, and installations shall be protected by the use of drop cloths or other precautionary measures.
- C. All damage to surfaces resulting from the Work shall be cleaned, repaired, and refinished to original condition.

3.3 STORAGE, MIXING, AND THINNING OF MATERIALS

- A. Manufacturer's Recommendations: Unless otherwise indicated, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.
- B. All protective coating materials shall be used within the manufacturer's recommended shelf life.
- C. Storage and Mixing: Coating materials shall be stored under the conditions recommended by the Material Safety Data Sheets, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.4 PREPARATION FOR COATING

- A. General: All surfaces to receive protective coatings shall be cleaned as indicated prior to application of coatings. Examine all surfaces to be coated, and correct surface defects before application of any coating material. All marred or abraded spots on shop-primed and on factory-finished surfaces shall receive touchup restoration prior to any coating application. Surfaces to be coated shall be dry and free of visible dust.
- B. Protection of Surfaces Not to be Coated: Surfaces which are not to receive protective coatings shall be protected during surface preparation, cleaning, and coating operations.
- C. All hardware, lighting fixtures, switchplates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not to be painted shall be removed, masked or otherwise protected. Drop cloths shall be provided to prevent coating materials from falling on or marring adjacent surfaces. The working parts of all mechanical and electrical equipment shall be protected from damage during surface preparation and coating operations. Openings in motors shall be masked to prevent entry of coating or other materials.
- D. Care shall be exercised not to damage adjacent work during blast cleaning operations. Spray painting shall be conducted under carefully controlled conditions. The CONTRACTOR shall be fully responsible for and shall promptly repair any and all damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.
- E. Protection of Painted Surfaces: Cleaning and coating shall be coordinated so that dust and other contaminants from the cleaning process will not fall on wet, newly coated surfaces.

3.5 SURFACE PREPARATION STANDARDS

- A. The following referenced surface preparation specifications of the Society for Protective Coatings shall form a part of this specification:
 1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.
 2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.
 3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.
 4. White Metal Blast Cleaning (SSPC-SP5): Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products and foreign matter by blast cleaning.
 5. Commercial Blast Cleaning (SSPC-SP6): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter,

except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.
7. Near-White Blast Cleaning (SSPC-SP10): Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

3.6 METAL SURFACE PREPARATION (UNGALVANIZED)

- A. The minimum abrasive blasting surface preparation shall be as indicated in the coating system schedules included at the end of this Section. Where there is a conflict between these Specifications and the coating manufacturer's printed recommendations for the intended service, the higher degree of cleaning shall apply.
- B. Workmanship for metal surface preparation shall be in conformance with the current SSPC Standards and this Section. Blast cleaned surfaces shall match the standard samples available from the National Association of Corrosion Engineers, NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive and TM-01-75 - Visual Standard for Surfaces of New Steel Centrifugally Blast Cleaned with Steel Grit.
- C. All oil, grease, welding fluxes, and other surface contaminants shall be removed by solvent cleaning per SSPC-SP1 - Solvent Cleaning prior to blast cleaning.
- D. All sharp edges shall be rounded or chamfered and all burrs, and surface defects and weld splatter shall be ground smooth prior to blast cleaning.
- E. The type and size of abrasive shall be selected to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. Abrasives for submerged and severe service coating systems shall be clean, hard, sharp cutting crushed slag. Automated blasting systems shall not be used for surfaces that will be in submerged service. Metal shot or grit shall not be used for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned to be one with hard, sharp cutting crushed slag.
- F. The abrasive shall not be reused unless an automated blasting system is used for surfaces that will be in nonsubmerged service. For automated blasting systems, clean oil-free abrasives shall be maintained. The abrasive mix shall include at least 50 percent grit.
- G. Comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.
- H. Compressed air for air blast cleaning shall be supplied at adequate pressure from well maintained compressors equipped with oil and moisture separators which remove at least 95 percent of the contaminants.

- I. Surfaces shall be cleaned of all dust and residual particles of the cleaning operation by dry air blast cleaning, vacuuming, or another approved method prior to painting.
- J. Enclosed areas and other areas where dust settling is a problem shall be vacuum cleaned and wiped with a tack cloth.
- K. Damaged or defective coating shall be removed by the specified blast cleaning to meet the clean surface requirements before recoating.
- L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be submerged in service, then SSPC-SP2 - Hand Tool Cleaning or SSPC-SP3 - Power Tool Cleaning, may be used.
- M. Shop-applied coatings of unknown composition shall be completely removed before the indicated coatings are applied. Valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment shall be examined for the presence of shop-applied temporary coatings. Temporary coatings shall be completely removed by solvent cleaning per SSPC-SP1 before the abrasive blast cleaning work has been started.
- N. Shop primed equipment shall be solvent cleaned in the field before finish coats are applied.

3.7 SHOP COATING REQUIREMENTS

- A. Unless otherwise indicated, all items of equipment, or parts of equipment which are not submerged in service, shall be shop primed and then finish coated in the field after installation with the indicated or selected color. The methods, materials, application equipment and all other details of shop painting shall comply with this section. If the shop primer requires topcoating within a specified period of time, the equipment shall be finish coated in the shop and then touchup painted after installation.
- B. All items of equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves, shall have all surface preparation and coating work performed in the field.
- C. The interior surfaces of steel water reservoirs, except for Part A surfaces, shall have all surface preparation and coating work performed in the field.
- D. For certain pieces of equipment it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switchgear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the indicated quality in the field. Such equipment shall be primed and finish coated in the shop and touched up in the field with the identical material after installation. Require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these Specifications. The coating material data sheet shall be submitted with the shop drawings for the equipment.
- E. For certain small pieces of equipment the manufacturer may have a standard coating system which is suitable for the intended service conditions. In such cases, the final

determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

- F. Shop painted surfaces shall be protected during shipment and handling by suitable provisions including padding, blocking, and the use of canvas or nylon slings. Primed surfaces shall not be exposed to the weather for more than 2 months before being topcoated, or less time if recommended by the coating manufacturer.
- G. Damage to shop-applied coatings shall be repaired in accordance with this Section and the coating manufacturers printed instructions.
- H. Make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Copies of applicable coating manufacturer's data sheets shall be submitted with equipment shop drawings.

3.8 APPLICATION OF COATINGS

- A. The application of protective coatings to steel substrates shall be in accordance with SSPC-PA1 - Paint Application Specification No. 1.
- B. Cleaned surfaces and all coats shall be inspected prior to each succeeding coat. Schedule such inspection with the CONSTRUCTION MANAGER in advance.
- C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.
- D. Coatings shall be applied in accordance with the manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.
- E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe painting for these areas.
- F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.
- G. Finish coats, including touchup and damage repair coats shall be applied in a manner which will present a uniform texture and color matched appearance.
- H. Coatings shall not be applied under the following conditions:
 - 1. Temperature exceeding the manufacturer's recommended maximum and minimum allowable.
 - 2. Dust or smoke laden atmosphere.
 - 3. Damp or humid weather.
 - 4. When the substrate or air temperature is less than 5 degrees F above dewpoint.

5. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dewpoint within 8 hours after application of coating.
6. When wind conditions are not calm.
 - I. Dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Dept. of Commerce, Weather Bureau psychometric tables.
 - J. Unburied steel piping shall be abrasive blast cleaned and primed before installation.
 - K. The finish coat on all Work shall be applied after all concrete, masonry, and equipment installation is complete and the Work areas are clean and dust free.

3.9 CURING OF COATINGS

- A. Maintain curing conditions in accordance with the conditions recommended by the coating material manufacturer or by this Section, whichever is the most stringent, prior to placing the completed coating system into service.
- B. In the case of enclosed areas, forced air ventilation, using heated air if necessary, may be required until the coatings have fully cured.
- C. Forced Air Ventilation of Steel Reservoirs and Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of steel reservoirs and enclosed hydraulic structures. During application and curing periods, continuously exhaust air from a manhole in the lowest shell ring, or in the case of an enclosed hydraulic structure, from the lowest level of the structure using portable ducting. After all interior coating operations have been completed, provide a final curing period for a minimum of 10 days, during which the forced ventilation system shall operate continuously.

3.10 SHOP AND FIELD INSPECTION AND TESTING

- A. General: Furnish the CONSTRUCTION MANAGER a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.
- B. All such Work shall be performed only in the presence of the CONSTRUCTION MANAGER, unless the CONSTRUCTION MANAGER has granted prior approval to perform such Work in its absence.
- C. Inspection by the CONSTRUCTION MANAGER, or the waiver of inspection of any particular portion of the Work, shall not relieve the CONTRACTOR of its responsibility to perform the Work in accordance with these Specifications.
- D. Scaffolding shall be erected and moved to locations where requested by the CONSTRUCTION MANAGER to facilitate inspection. Additional illumination shall be furnished to cover all areas to be inspected.
- E. Inspection Devices: Furnish, until final acceptance of such coatings, inspection devices in good working condition for the detection of holidays and measurement of dry-film

thicknesses of protective coatings. Dry-film thickness gauges shall be made available for the CONSTRUCTION MANAGER's use at all times while coating is being done, until final acceptance of such coatings. Furnish the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Holiday detection devices shall be operated only in the presence of the CONSTRUCTION MANAGER.

- F. Holiday Testing: Holiday test all coated ferrous surfaces inside a steel reservoir, other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Areas which contain holidays shall be marked and repaired or recoated in accordance with the coating manufacturer's printed instructions and then retested.
1. Coatings With Thickness Exceeding 20 Mils: For surfaces having a total dry film coating thickness exceeding 20 mils: pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal shall be used. The unit shall be adjusted to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.
 2. Coatings With Thickness of 20 Mils or Less: For surfaces having a total dry film coating thickness of 20 mils or less: Tinker & Rasor Model M1 nondestructive type holiday detector, K-D Bird Dog, or equal shall be used. The unit shall operate at less than 75 volts. For thicknesses between 10 and 20 mils, a nonsudsing type wetting agent, such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.
- G. Film Thickness Testing: On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On nonferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using a wet film gauge.
- H. Surface Preparation: Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standards TM-01-70 and TM-01-75.

-END OF SECTION-

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, installation, testing, and operation of all equipment and appurtenant Work, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to all equipment specified and where referred to, except where otherwise indicated.
- C. Single Manufacturer: Where two or more equipment items of the same type or size are required, the equipment shall be produced by the same manufacturer.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section of these Specifications:
 1. American Society for Testing and Materials (ASTM).
 2. American Public Health Association (APHA).
 3. American National Standards Institute (ANSI).
 4. American Society of Mechanical Engineers (ASME).
 5. American Water Works Association (AWWA).
 6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
 7. American Welding Society (AWS).
 8. National Fire Protection Association (NFPA).
 9. Federal Specifications (FS).
 10. National Electrical Manufacturers Association (NEMA).
 11. Manufacturer's published recommendations and specifications.
 12. General Industry Safety Orders (OSHA).
- B. The following standards have been referred to in this Section of the Specifications:

ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings Class 25,
125, 250, and 800

ANSI B16.5

Pipe Flanges and Flanged Fittings, Steel, Nickel Alloy,
and Other Special Alloys

ANSI B46.1

Surface Texture

ANSI S12.6

Method for the Measurement of the Real-Ear
Attenuation of Hearing Protectors

ANSI/ASME B1.20.1

General Purpose Pipe Threads (Inch)

ANSI/ASME B31.1

Power Piping

ANSI/AWWA D100

Welded Steel Tanks for Water Storage

AWWA C206

Field Welding of Steel Water Pipe

ASTM A 48

Specification for Gray Iron Castings

ASTM A 108

Specification for Steel Bars, Carbon, Cold-Finished,
Standard Quality

1.3 CONTRACTOR SUBMITTALS

- A. Shop Drawings: The CONTRACTOR shall furnish complete shop drawings for all equipment specified in the various Sections, together with all piping, valves, and controls for review by the CONSTRUCTION MANAGER in accordance with Section 01300 - Contractor Submittals.
- B. Tools: The CONTRACTOR shall supply one complete set of special wrenches and other special tools necessary for the assembly, adjustment, and dismantling of the equipment. All tools shall be of best quality hardened steel forgings with bright, finish wrench heads shall have work faces dressed to fit nuts. All tools shall be suitable for professional work and manufactured by a recognized supplier of professional tools such as Snap On, Crescent, Stanley, or equal. The set of tools shall be neatly mounted in a labeled tool box of suitable design provided with a hinged cover. For each microprocessor-based equipment system requiring a handheld device for configuration, furnish one handheld device.
- C. Spare Parts: The CONTRACTOR shall obtain and submit from the manufacturer a list of suggested spare parts for each piece of equipment. After approval, CONTRACTOR shall furnish such spare parts suitably packaged, identified with the equipment number, and labeled. CONTRACTOR shall also furnish the name, address, and telephone number of the nearest distributor for each piece of equipment. All spare parts are intended for use by the AUTHORITY only, after expiration of the guaranty period.
- D. Torsional Analysis: The CONTRACTOR shall submit to the CONSTRUCTION MANAGER a torsional and lateral vibration analysis of the following equipment, in accordance with Section 01300 - Contractor Submittals and the specific equipment sections. The analysis has to be performed by a specialist experienced in this type of Work and approved by the CONSTRUCTION MANAGER.
 - 1. All engine drives.

2. All blowers and compressors with drives of 100 horsepower and over.
3. All vertical pumps with universal joints and extended shafts.
4. All other equipment where indicated.

The torsional natural frequency of the drive train must be avoided by plus and minus 20 percent by any exciting frequency of the equipment, throughout the entire operating range.

- E. Vibration Analysis: In his bid price the CONTRACTOR shall include at least two site visits of the above mentioned specialist, during construction and testing of the equipment, to analyze and measure the amount of equipment vibration and make his written recommendation for keeping the vibration at a safe limit.
- F. Operation and Maintenance Manuals: Submit in accordance with Section 01300 – Contractor Submittals.
- G. Except where otherwise indicated, the lateral critical speeds of any piece of equipment in a train shall be at least 20 percent above maximum indicated operating speed or 20 percent below minimum indicated operating speed.

1.4 QUALITY ASSURANCE

- A. Inspection, Startup, and Field Adjustment: The CONTRACTOR shall demonstrate that all equipment meets the specified performance requirements. CONTRACTOR shall provide the services of an experienced, competent, and authorized service representative of the manufacturer of each item of major equipment who shall visit the site to perform the following tasks:
 1. Assist the CONTRACTOR in the installation of the equipment.
 2. To inspect, check, adjust if necessary and approve the equipment installation.
 3. To start-up and field-test the equipment for proper operation, efficiency, and capacity.
 4. To perform necessary field adjustments during the test period until the equipment installation and operation are satisfactory to the CONSTRUCTION MANAGER.
 5. To instruct the AUTHORITY's personnel in the operation and maintenance of the equipment. Instruction shall include step-by-step trouble shooting procedures with all necessary test equipment.
- B. Costs: The costs of all inspection, startup, testing, adjustment, and instruction Work performed by said factory-trained representatives shall be borne by the CONTRACTOR. The AUTHORITY will pay for costs of power and water. When available, the AUTHORITY'S operating personnel will provide assistance in the field testing.
- C. Public Inspection: It shall be the responsibility of the CONTRACTOR to inform the local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others, to witness all required tests for piping, plumbing, fire protection systems, pressure vessels, and safety systems to obtain all required permits and certificates, and pay all fees.

- D. Tolerances: Tolerances and clearances shall be as shown on the shop drawings and shall be closely adhered to. Machine Work shall in all cases be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16-inch for members 30 feet or less in length, and not greater than 1/8-inch for members over 30 feet in length.
- E. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:
1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.
 2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.
 3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.
 4. Contact surfaces of shafts and stems which pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.
- F. [Manufacturer's Experience: Unless otherwise directed by the CONSTRUCTION MANAGER, all equipment furnished shall have a record of at least 5 years of successful, trouble free operation in similar applications, from the same manufacturer.]

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. High Noise Level Location: The CONTRACTOR shall provide one personal hearing protection station, as indicated herein, at each high noise level location. Said locations are defined as follows:
1. Outdoor Location: Any single equipment item or any group of equipment items that produce noise exceeding OSHA noise level requirements for a 2-hour exposure. Where such equipment is separated by a distance of more than 20 feet, measured between edges of footings, each group of equipment shall be provided with a separate hearing protection station.
 2. Indoor Location
 - a. Any single equipment item, or any group of equipment items, located within a single room not normally occupied, that produces noise exceeding OSHA noise level requirements for a 2-hour exposure.
 - b. Any single equipment item, or any group of equipment items, located within a single room normally occupied by workers, that produces noise exceeding OSHA noise level requirements for an 8-hour exposure.

3. Personal Hearing Protection: The CONTRACTOR shall supply, in their original unopened packaging, three pairs of high attenuation hearing protectors. The ear protectors shall be capable of meeting the requirements of ANSI S12.6 and shall produce a noise level reduction of 25 dBA at a frequency of 500 Hz. The hearing protectors shall have fluid filled ear cushions and an adjustable, padded headband. The protectors shall be stored in a weatherproof, labeled, steel cabinet, furnished by the CONTRACTOR and mounted in an approved location near the noise protection station.
- B. Service Factors: Service factors shall be applied in the selection or design of mechanical power transmission components. Unless otherwise indicated, the following load classifications shall apply in determining service factors:

Type of Equipment	Load Classification
Blower:	
Centrifugal or vane	Uniform
Lobe	Moderate Shock
Reciprocating Air Compressor:	
Multi-Cylinder	Moderate Shock
Single-Cylinder	Heavy Shock
Pump:	
Centrifugal or Rotary	Uniform
Reciprocating	Moderate Shock
Mixer:	
Constant Density	Uniform
Variable Density	Moderate Shock
Crane or Hoist	Moderate Shock

- C. For service factors of electric motors, see Section 16460 - Electric Motors. Where load classifications are not indicated, best modern practice shall be used.
- D. Welding: Unless otherwise indicated, all welding shall conform to the following:
1. Latest revision of ANSI/AWWA D100.
 2. Latest revision of AWWA C206.
 3. All composite fabricated steel assemblies which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.
 4. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

5. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
- E. Protective Coating: All equipment shall be painted or coated in accordance with Section 09800 - Protective Coating, unless otherwise indicated. Nonferrous metal and corrosion-resisting steel surfaces shall be coated with grease or lubricating oil. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.
- F. Protection of Equipment: All equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage by methods recommended by the manufacturer. All equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities prior to installation. For extended storage periods, plastic equipment wrappers should be avoided, to prevent accumulation of condensate in gears and bearings.
- G. Identification of Equipment Items: Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number indicated for the particular item. Metal tags shall be stainless steel with embossed lettering. Plastic tags shall be of solid black plastic laminate with white letters. All tags shall be designed to be firmly attached to the equipment or to the structure immediately adjacent to such equipment"
- H. Vibration Level: All equipment subject to vibration shall be provided with restrained spring-type vibration isolators or pads per manufacturer's written recommendations.
- I. Shop Fabrication: Shop fabrication shall be performed in accordance with the Contract Documents and the CONSTRUCTION MANAGER-approved shop drawings.

2.2 EQUIPMENT SUPPORTS AND FOUNDATIONS

- A. Equipment Supports: All equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads. The design horizontal seismic force shall be the greater of: that noted in the general structural notes or as required by Section 1621 and 1622 of IBC, or 10 percent of gravity. Submitted design calculations for equipment supports must bear the signature and seal of an engineer registered in Nevada.
- B. Equipment Foundations: Equipment foundations shall be as per manufacturer's written recommendations. All mechanical equipment, tanks, and control cabinets shall be mounted on concrete bases as shown on standard structural details.
- C. Shop Drawings: Shop drawings shall be submitted to the CONSTRUCTION MANAGER for review in accordance with the requirements of Section 01300 - Contractor Submittals. Shop drawings will be considered incomplete unless clear, concise calculations are presented showing equipment anchorage forces and the capacities of the anchorage elements provided by the CONTRACTOR.

2.3 PIPE HANGERS, SUPPORTS, AND GUIDES

- A. All pipe connections to equipment shall be supported, anchored, and guided to avoid stresses and loads on equipment flanges and equipment. Supports and hangers shall be in accordance with the requirements of Section 15006 - Pipe Supports.

2.4 FLANGES AND PIPE THREADS

- A. All flanges on equipment and appurtenances provided under this Section shall conform to ANSI B16.1, Class 125; or B16.5, Class 150, unless otherwise indicated. All pipe threads shall be in accordance with ANSI/ASME B1.20.1, and with requirements of Section 15000 - Piping, General.

2.5 COUPLINGS

- A. Flexible couplings shall be provided between the driver and the driven equipment to accommodate slight angular misalignment, parallel misalignment, end float, and to cushion shock loads. Where required for vertical shafts, 3-piece spacer couplings or universal type couplings for extended shafts shall be installed.
- B. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application.
- C. Taper-lock bushings may be used to provide for easy installation and removal on shafts of various diameters.
- D. Where universal type couplings are shown, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.6 SHAFTING

- A. General: All shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. All shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.
- B. Materials: Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as indicated unless furnished as part of an equipment assembly.
 1. Low carbon cold-rolled steel shafting shall conform to ASTM A 108, Grade 1018.
 2. Medium carbon cold-rolled shafting shall conform to ASTM A 108, Grade 1045.
 3. Corrosion-resistant shafting shall be stainless steel or Monel, whichever is most suitable for the intended service.
- C. Differential Settlement: Where differential settlement between the driver and the driven equipment may be expected, a shaft of sufficient length with two sets of universal type couplings shall be provided.

- A. General: Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).
- B. To assure satisfactory bearing application, fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other important factors shall be considered in bearing selection.
- C. All re-lubricatable type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.
- D. All lubricated-for-life bearings shall be factory-lubricated with the manufacturer's recommended grease to insure maximum bearing life and best performance.
- E. Bearing Life: Except where otherwise indicated, all bearings shall have a minimum L-10 life expectancy of 5 years or 20,000 hours, whichever occurs first. Where indicated, bearings shall have a minimum rated L-10 life expectancy corresponding to the type of service, as follows:

Type of Service	Design Life (years)*	L-10 Design Life (hours)*
8-hour shift	10	20,000
16-hour shift	10	40,000
Continuous	10	60,000

* = Design Life in years or L-10 Design Life in hours, whichever occurs first

- F. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as indicated, or as recommended in the published standards of the manufacturer if not indicated. Split-type housings may be used to facilitate installation, inspection, and disassembly.
- G. Sleeve-type bearings shall have a Babbitt or bronze liner unless indicated otherwise.
- H. Manufacturers shall furnish data detailing bearing type and features of each piece of equipment.

2.8 GEARS AND GEAR DRIVES

- A. Unless otherwise indicated, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum service factor of 1.7, a minimum L-10 bearing life of 60,000 hours and a minimum efficiency of 94 percent. Worm gears shall not be used, unless specifically approved by the CONSTRUCTION MANAGER.
- B. All gear speed reducers or increases shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. The casing shall be of cast iron or heavy duty steel construction with lifting lugs and an inspection cover for each gear train. An oil level sight glass and an oil flow indicator shall be provided, arranged for easy reading.

- C. Gears and gear drives as part of an equipment assembly shall be shipped fully assembled for field installation.
- D. Material selections shall be left to the discretion of the manufacturer, provided the above AGMA values are met. Input and output shafts shall be adequately designed for the service and load requirements. Gears shall be computer-matched for minimum tolerance variation. The output shaft shall have two positive seals to prevent oil leakage.
- E. Oil level and drain location relative to the mounting arrangement shall be easily accessible. Oil coolers or heat exchangers with all required appurtenances shall be furnished when necessary.
- F. Where gear drive input or output shafts have to connect to couplings or sprockets supplied by others, the CONTRACTOR shall have the gear drive manufacturer supply matching key taped to the shaft for shipment.

2.9 DRIVE CHAINS

- A. Power drive chains shall be commercial type roller chains and meet ANSI Standards.
- B. A chain take-up or tightener shall be provided in every chain drive arrangement to provide easy adjustment.
- C. A minimum of one connecting or coupler link shall be provided with each length of roller chain.
- D. Chain and attachments shall be of the manufacturer's best standard material and suitable for the process fluid.

2.10 SPROCKETS

- A. General: Sprockets shall be used in conjunction with all chain drives and chain-type material handling equipment.
- B. Materials: Unless otherwise indicated, materials shall be as follows:
 1. Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45 percent carbon range.
 2. Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20 percent carbon steel.
 3. Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A 48, Class 30.
- C. All sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.
- D. Finish bored sprockets shall be furnished complete with keyseat and set screws.
- E. To facilitate installation and disassembly, sprockets shall be of the split type or shall be furnished with taper-lock bushings as required.

F. Idler sprockets shall be furnished with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with set screws may be provided in both sides of the hub.

2.11 V-BELT DRIVES

- A. V-belts and sheaves shall be of the best commercial grade and shall conform to ANSI, MPTA, and RMA Standards.
- B. Unless otherwise indicated, sheaves shall be machined from the finest quality gray cast iron.
- C. All sheaves shall be statically balanced. In some applications where vibration is a problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 fpm may be required to be of special materials and construction.
- D. To facilitate installation and disassembly, sheaves shall be furnished complete with taper-lock or QD bushings as required.
- E. Finish bored sheaves shall be furnished complete with keyseat and set screws.
- F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.12 DRIVE GUARDS

- A. All power transmission, prime movers, machines, shaft extensions, and moving machine parts shall be guarded to conform with the OSHA Safety and Health Standards (29CFR1910). The guards shall be constructed of minimum 10 gauge expanded, flattened steel with smooth edges and corners, galvanized after fabrication and securely fastened. Where required for lubrication or maintenance, guards shall have hinged and latched access doors.

2.13 FLEXIBLE CONNECTORS

- A. General: Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment and in piping systems in accordance with Section 15000 - Piping, General.

2.14 INSULATING CONNECTIONS

- A. General: Insulating bushings, unions, couplings, or flanges, as appropriate, shall be used in accordance with the requirements of the Section 15000 - Piping, General.

2.15 GASKETS AND PACKINGS

- A. Gaskets shall be in accordance with the requirements of Section 15000 - Piping, General.
- B. Packing around valve stems and reciprocating shafts shall be of compressible material, compatible with the fluid being used. Chevron-type "V" packing shall be Garlock No. 432, John Crane "Everseal," or equal.

- C. Packing around rotating shafts (other than valve stems) shall be "O"-rings, stuffing boxes, or mechanical seals, as recommended by the manufacturer and approved by the CONSTRUCTION MANAGER, in accordance with Section 11100 - Pumps, General.

2.16 NAMEPLATES

- A. Equipment nameplates of stainless steel shall be engraved or stamped and fastened to the equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins. Nameplates shall contain the manufacturer's name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.17 SAFETY REQUIREMENTS

- A. Where Work areas are located within a flammable or toxic gas environment, suitable gas detection, ventilating, and oxygen deficiency equipment shall be provided. Workers shall be equipped with approved breathing apparatus.

2.18 OVERLOAD PROTECTION

- A. General: Unless otherwise indicated in individual equipment Sections, all equipment drives incorporating overload protection shall be provided with an overload protection device as follows:
- B. Mechanical Torque Monitoring System: The overload protection shall be a mechanical device to provide for reliable protection in the event of excessive overload. It shall be a ball detent type designed for long term repeatability and life. It shall be infinitely adjustable by a single adjusting nut. Once set it shall be tamperproof, and incorporate a torque monitoring and control system. It shall activate an alarm set for 85 percent, and a motor cutout switch set for 100 percent of maximum continuous running torque. A visual torque indication shall be provided and oriented so that it may be read from the walkway. The dial shall be calibrated from 0 to 100 percent of maximum continuous running torque. The design of the torque limiter should initiate the mechanical disengagement of the drive upon overload. Each unit shall be suitable for outdoor/corrosive environments with a protective finish, corrosion inhibiting lubricants and a stainless steel cover.
- C. Electronic Torque Monitoring System: As an alternative to the mechanical system, the overload protection may be an Electronic Torque Monitoring Control System capable of displaying torque, rpm's, one level of overload, and two levels of overload of the drive system. It shall incorporate a time-delay for start-up and a voltage monitoring and compensation circuit for up to ± 15 percent variation.

The overload device shall be housed in an enclosure with NEMA rating in accordance with the area designations of Section 16050 - Electrical General Provisions. A visual torque dial shall be provided and oriented so that it can be easily read from the walkway.

The torque monitoring system shall be calibrated to: alarm and shut down the system in the event the torque drops to 50 percent of normal running; alarm at 85 percent of maximum continuous running torque and shut down the motor at maximum continuous running torque of the equipment. The system shall be calibrated at the factory of the equipment manufacturer and it shall be capable of monitoring twice the maximum continuous running torque of the equipment.

- D. Manufacturers, or Equal

1. American Autogard Corporation;
2. Ferguson Machine Company.

PART 3 -- EXECUTION

3.1 COUPLINGS

- A. The CONTRACTOR shall have the equipment manufacturer select or recommend the size and type of coupling required to suit each specific application; installation shall be per equipment manufacturer's printed recommendations.

3.2 INSULATING CONNECTIONS

- A. All insulating connections shall be installed in accordance with the manufacturer's printed instructions.

3.3 PIPE HANGERS, SUPPORTS, AND GUIDES

- A. Hangers, supports, seismic bracing and guides shall be spaced in accordance with ANSI/ASME B.31.1 standard, and with tables in Section 15006 - Pipe Supports.

3.4 PACKAGED EQUIPMENT

- A. When any system is furnished as pre-packaged equipment, the CONTRACTOR shall coordinate with subcontractors all necessary space and structural requirements, clearances, utility connections, signals, and outputs.
- B. If the packaged system has any additional features (for example, safety interlocks), other than indicated, the CONTRACTOR shall coordinate such features with the CONSTRUCTION MANAGER and furnish all material and labor necessary for a complete installation as required by the manufacturer, at no additional cost to the AUTHORITY.

- END OF SECTION -

18449.07.03

CHLORINATION EQUIPMENT
SECTION 11261 - Page 1**SECTION 11261 - CHLORINATION EQUIPMENT****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Chlorinators.
- B. Control systems.
- C. Chlorine flow recorders, detectors, control panel, gas manifold, and booster pump.
- D. Valves.
- E. Scales, gas mask, and miscellaneous equipment.

1.02 RELATED SECTIONS

- A. Section 01330 - Submittals Procedures.
- B. Section 01400 - Quality Requirements.
- C. Section 01700 - Execution Requirements.
- D. Section 11399 - Equipment Installation.

1.03 SYSTEM DESCRIPTION

- A. Equipment shall be operated by manual control system designed, furnished, and installed to perform as follows:
 1. Chlorinators shall be controlled manually.
 2. 4-20 mA signal shall be transmitted to electric positioner in the chlorinator to control V-notch orifice opening area. Electric positioner shall have 4-20 mA isolated input terminals from 120-volt ac ground through optical isolation means or similar method.
- B. Equipment shall be corrosion-resistant with moving parts in gastight enclosures.
- C. Components, materials, and treatment chemicals that come into contact with potable water shall be certified for conformance to ANSI/NSF Standard 60 or 61, as applicable.
- D. Power supply to chlorination equipment *except for evaporator and booster pump shall be ~~260volts~~
~~ac single phase~~ 60 Hz of adequate capacity to serve facility. Distribution to components shall be coordinated by Contractor.
- E. System shall include following:
 1. Automatic switchover system as specified and indicated.
 2. Vacuum regulators as specified and indicated.
 3. Gas feeders (chlorinators) as specified and indicated.

CHLORINATION EQUIPMENT

18449.07.03

Page 2 - SECTION 11261

4. Controllers for each chlorinator and located in electrical compartment room as specified.
5. Instrumentation with alarms located on chlorination monitoring panel (CMP) located in the electrical compartment.
6. Chlorine gas leak detectors.
7. Self-contained breathing apparatus as specified and located in the electrical compartment.
8. Extra materials as specified.

1.04 SUBMITTALS

- A. Shop Drawings showing arrangements, dimensions, materials, and electrical data.
- B. Characteristic performance curve for chlorine booster pump, showing total dynamic head, efficiency, and brake horsepower plotted against capacity in gpm with required impeller size.
- C. Certification by nationally recognized, independent organization that components, materials, and treatment chemicals in contact with potable water conform to ANSI/NSF Standard 60 or 61, as applicable.
- D. Submit copy of this Section with addenda and referenced sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from specified requirements.
 1. If deviations and clarifications from Specifications are indicated and requested by Contractor, provide detailed written justification for each deviation and clarification.
 2. Failure to include copy of marked-up specification sections and or detailed justifications for requested deviation or clarification will result in rejection of submittal with no further review and consideration.

1.05 EXTRA MATERIALS

- A. Multipurpose wrench for use on chlorine cylinders used.
- B. 20 lead gaskets for connections between cylinders and feed line.
- C. Bottle of ammonia solution.
- D. Tube of lubricant.
- E. 1 set of chlorinator spare parts.

PART 2 PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Bailey-Fisher & Porter Co.
- B. Capital Controls Company, Inc.
- C. Regal-Chlorinators, Inc.
- D. Wallace & Tiernan Division, Pennwalt Corporation.
- E. Or equal.

18449.07.03

CHLORINATION EQUIPMENT
SECTION 11261 - Page 3

2.02 CHLORINATORS

- A. Quantity: 1.
- B. Capacity:
 - 1. Chlorinator No. 1: 50 lb/day.
- C. Type: Gas-feed, wall-mounted with electric positioner.
- D. Feed rate: Manually adjustable over a 20:1 range.
- E. Accessories:
 - 1. Vacuum supply gage.
 - 2. Vacuum regulator-check unit.
 - 3. Rotameter.
 - 4. V-notched variable orifice with manual feed rate adjuster.
 - 5. Vacuum relief valve.
 - 6. Differential regulating valve.
 - 7. Injector vacuum gage.
 - 8. Injector apparatus.
 - 9. Standby pressure relief valve.

2.03 CHLORINE FLOW RECORDER

- A. Quantity: 1.
- B. Type: Record rate of chlorine flow; direct-reading in pounds of chlorine per 24 hr.; integrator shall totalize chlorine gas used; enclosed in wall mounted cabinet.
- C. Accuracy: $\pm 0.5\%$ of maximum flow as indicated on rotameter over a 20 to 1 range.
- D. Charts:
 - 1. Range of 0-200 lb/day.
 - 2. 7-day charts with chart drive.
 - 3. One year's supply of charts and ink for each recorder.

2.04 CHLORINE DETECTORS

- A. Quantity: 1, located in chlorination compartment.
- B. Type: Amperometric measurement of chlorine gas; actuate alarms and discontinue chlorine gas flow at predetermined concentration; wall-mounted.
- C. Sampling: Monitor a minimum of 1.0 cfm (1.7 cm/hr) of air from blowers mounted in module.
- D. Sensitivity: 1.0 ppm: chlorine (by volume) in air.
- E. Accessories:
 - 1. One year's supply of electrolyte tablets, activated carbon, and electrolyte based on standard operating procedures.

CHLORINATION EQUIPMENT
Page 4 - SECTION 11261

18449.07.03

2. Central alarm red lights mounted on chlorine control panel and buzzer with indicating light located outside doors to chlorinator room and chlorine storage room in an enclosure suitable for outdoor installation.
3. Screens for vent outlets.
4. Filter for air sample line.
5. Power-on light.
6. Alarm-reset button.

2.05 CHLORINE CONTROL PANEL

- A. Wall-mounted NEMA 12 panel to match other equipment panels included in modular installation, located where shown on Drawings.
- B. Panel shall contain:
 1. Selector switches and running lights for chlorinators, and chlorine detectors.
 2. Alarm light for high chlorine concentration in chlorination compartment.
 3. Alarm light for high and low chlorine residual.
 4. Power and 120-volt ac control wiring shall be 14 AWG (2.5 mm^2)stranded copper with MTW insulation. Low voltage dc wiring shall be No. 16 (2 mm^2) shielded cable. Tape shield on one end of cable and connect other end of shield to common ground. Wire shall be looped in such a manner that any item can be removed without interrupting power of circuit. Use space lugs where applicable. Wire insulation color codes shall be as follows unless local codes require otherwise.
 - a. 120-volt ac supply: Black.
 - b. 120-volt ac control: Red.
 - c. Neutrals: White.
 - d. Grounds: Green.
 - e. 24 volts dc: Blue.
 5. Terminal strips shall be Buchanan 600-volt nylon sectional, Catalog No. 0725 with tubular clamp contact, or equal. Wireway and adequate terminals shall be provided for field wiring; 20% spare terminals shall be provided for associated external interlocks and alarms. Group terminals for outgoing cables in logical manner in accordance with type and destination. Separate ac and dc terminal blocks. Ac and dc control wiring shall be separately routed in panel.
 6. Both ends of wires shall be identified with permanent wire markers. Wire markers shall be embossed heat-shrink tubing; color, white.
 7. Wiring shall be installed in accordance with applicable provisions of National Electrical Code.
 8. Each internally mounted component shall be clearly identified by nameplate adjacent to mounted unit.
 9. Pushbuttons for equipment control shall be clearly identified by nameplate adjacent to mounted unit.
 10. Selector switches for equipment control shall be miniature oiltight operator with standard operating lever. Number of positions and contacts as dictated by design. Suitable for mounting on panel front and for 120 volts ac operation; Allen-Bradley Type 800T, or equal.
 11. Indicating lights for equipment status indication shall be miniature oiltight push-to-test, or cluster type, transformer type, suitable for mounting on panel front and for 120-volt ac operation; Allen-Bradley Type 800T, or equal.
 12. Auxiliary relays (if required):
 - a. Relays: Allen-Bradley Series 700, or equal.
 - b. Timing relays: Agastat Series 7000, or equal.
 - c. Contact arrangement and current carrying capabilities as dictated by design.
 - d. Complete with mounting hardware and wiring accessories.
 13. Nameplates:
 - a. Provide permanent nameplates for devices mounted on or within panels. Plastic tape labeling of interior devices is not acceptable.

18449.07.03

CHLORINATION EQUIPMENT
SECTION 11261 - Page 5

- b. Type: Black, laminated engraving stock with white core.
- c. Size: As required; sizes of nameplates for similar devices shall be identical.
- d. Lettering: As required to describe control function.
- e. Attach nameplates with heat-resistant, waterproof adhesive as manufactured by Hermes Manufacturing, or equal.
- 14. Painting:
 - a. Manufacturer's standard interior and exterior paint shall be acceptable as a primer coat.
 - b. Prepare exterior surface for finish coat of paint as required.
 - c. Exterior surfaces shall be painted with Glidden "Glid-Guard Glid-Tile Epoxide No. 5558/5552," or equal satin finish tinted to slate gray color.
 - d. For final coat, gloss shall be between 10° and 15° on a 60° glossmeter.
 - e. Paints shall be spray-applied to produce smooth uniform coat, free of defects. SSPC PA-1 shall apply.
 - f. Each coat shall be properly cured according to manufacturer's instructions before application of succeeding coats.

2.06 AUTOMATIC SWITCHOVER VALVES

- A. Quantity: 2.
- B. Type: Wall-mounted, remote vacuum, automatic, regulator-check type units.
- C. Switchover valves shall automatically switch over to new supply source on vacuum demand and shall be designed to assure complete emptying of cylinders.

2.07 SCALES

- A. Quantity: 1.
- B. Type: Portable 2-cylinder platform.
- C. Capacity: 2 cylinders; 150 lb, each indicator.

2.08 CHLORINE BOOSTER PUMP

- A. Quantity: 1.
- B. Type: End suction centrifugal.
- C. Materials: Bronze fitted, bronze impeller, stainless steel shaft.
- D. Head characteristics for pumps: Continuously rising as flow is decreased. Shutoff head shall be minimum of 1.2 times rated head.
- E. Maximum speed: 1,750 rpm.
- F. Pump shall be suitable for continuous operation at flow conditions specified without excessive noise, vibration, heating, cavitation, or damage to pump.
- G. Motor:
 - 1. Type: Horizontal, squirrel cage induction, solid shaft. Provide grease-lubricated ball bearings.
 - 2. Enclosure: TEFC, suitable for NEC Class I, Group D, Division 2 locations.
 - 3. Starting: Full-voltage, across-the-line.
 - 4. Ratings:
 - a. Continuous duty.

CHLORINATION EQUIPMENT
Page 6 - SECTION 11261

18449.07.03

- b. Nameplate motor horsepower shall be not less than maximum required pump input for all conditions of head and capacity for full range of impeller furnished.
~~• Available 24/7 365 days a year~~
- d. Service factor: NEMA standard.

2.09 GAS MASK

- A. Quantity: 1.
- B. Type: Refillable air-tank using compressed air, 30-minute supply. Full-vision face mask suitable for use by persons wearing eyeglasses, with shatterproof glass eyepiece cushioned in rubber; and easily adjustable head straps.
- C. Alarm: Audible warning device which signals diminishing tank supply.
- D. Foam-padded cylinder harness assembly.
- E. Cabinet: Provide 1 steel storage cabinet for each tank and gas mask furnished. Design for wall mounting and outdoor use. Door shall be gasketed and weathertight with key lock-type handle.

2.10 MISCELLANEOUS EQUIPMENT

- A. Chlorine gas supply and vent tubing complete with screens suitable for outdoor installation.
 - 1. Tubing: Polyethylene and sized as necessary for vacuum service and flows specified and for distances and orientation shown on Drawings.
 - 2. Length: As necessary for distances shown on Drawings.
- B. Provide safety chains with snap hooks at one end, for storage of 4 individual 150 lb chlorine cylinders.
- C. Provide 1 amperometric titrator with a 0.1 ppm sensitivity to residual chlorine. Accessories shall include:
 - 1. Plastic sample container.
 - 2. Polyethylene bottle for titrant.
 - 3. 4 oz phenylarsene oxide.
 - 4. 1 and 5 ml pipettes.
 - 5. 4 oz pH 4 and pH 7 buffer.
 - 6. Potassium iodide, droppers, and bottles for chemicals.
 - 7. Electrolyte tablets.
- D. Hand truck for moving 150 lb (68 kg) chlorine cylinders.
- E. Provide 1 solenoid-actuated gas shut-off valve on each main chlorine gas line. Fail-close valve permits gas to flow to chlorinator when energized. Valve shall have TFE seat and be chemical-resistant to chlorine gas.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install chlorine equipment and accessories in accordance with manufacturer's recommendations.
- B. Clean, test, and purge chlorine gas piping and tubing with nitrogen gas in accordance with manufacturer's recommendations.

18449.07.03

CHLORINATION EQUIPMENT
SECTION 11261 - Page 7

3.02 MANUFACTURER'S FIELD SERVICES

- A. Provide qualified service representative to perform equipment check-out *and start-up* as necessary to:
 - 1. Inspect equipment after installation to assure that details of installation are correct and that equipment is prepared for operation in accordance with manufacturer's instructions and recommendations.
 - 2. Check connections to equipment and adjust, or supervise adjustment of, control and indicating devices after equipment has been installed and connected.
 - 3. Fully instruct Owner's operating personnel in operation and maintenance of equipment.
 - 4. Supervise preliminary operation of equipment and such adjusting as necessary.
- B. Presence of service representative will in no way relieve Contractor of any responsibility assumed under this contract.
- C. Work and abilities of service representative(s) shall be subject to review of Engineer. If Engineer determines that any service representative(s) is not properly qualified, Contractor shall replace service representative(s) at its expense upon written notification by Engineer.

END OF SECTION

SECTION 15000 – PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.
- B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Commercial Standards

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
ANSI/ASME B16.5	Pipe Flanges and Flanged Fittings, NPS ½ to NPS 24
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
ANSI/AWWA C 219	Bolted, Sleeve-Type Couplings for Plain-End Pipe
ANSI/AWWA C606	Grooved and Shouldered Joints
ANSI/AWS D1.1	Structural Welding Code
ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.3 CONTRACTOR SUBMITTALS

- A. Submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01300 - Contractor Submittals, and as indicated in the individual piping sections. The shop drawings shall